# NOTES ON MALAYAN DIPTEROCARPACEAE V*

*by* C. F. SYMINGTON,
*Forest Research Institute, Kepong*

The bulk of this paper is composed of the results of my investigations of species of *Hopea* belonging to the *Bracteata* and *Dryobalanoides* groups. These results are somewhat cataclysmic, involving the addition of ten names to the list of Malay Peninsula species, but as I have been fortunate in being able to study all the critical material concerned, it is hoped that reasonable stability in the nomenclature of *Hopea* will result.

In preparing the botanical notes for Desch's *Commercial Timbers of the Malay Peninsula:* I, *the genus Shorea* [*Mal. For. Rec.* 12 (1936)] I endeavoured to straighten out the nomenclature of our species as far as possible at the time, but, for one reason or another, some species received tentative names only. In the last paper in this series a few of these species were given more permanent binomials, while in this paper most of the remainder are considered. The recent acquisition of flowering herbarium material of *Shorea atrinervosa, S. lumutensis,* and *S. Meadiana,* has made it possible to describe these three species, all of which are in the *Eushorea* group, while additional field and herbarium study has revealed the desirability of changing the names or status of several other species.

One of the name-changes involved is that of *Shorea eximia* (Miq.) Scheff. to *S. ovalis* (Korth.) Bl. I mention this in particular, because it illustrates very nicely the sort of problem the systematist has frequently to tackle in this region. *S. ovalis* is based upon a sterile specimen of seedling leaves which differ very markedly from those of the mature tree. Thus, before the species could be interpreted it was essential, firstly, *to see the type specimen,* and secondly, *to have representative collections of immature stages of this form for comparison.* The first of these precepts is generally appreciated, although not always followed by the systematist, owing to impatience or necessity: but to the second, I think, inadequate attention is given. The much despised, sterile, immature specimen is frequently the key to interpretation of early, obscure species, which play such havoc with accepted nomenclature if they

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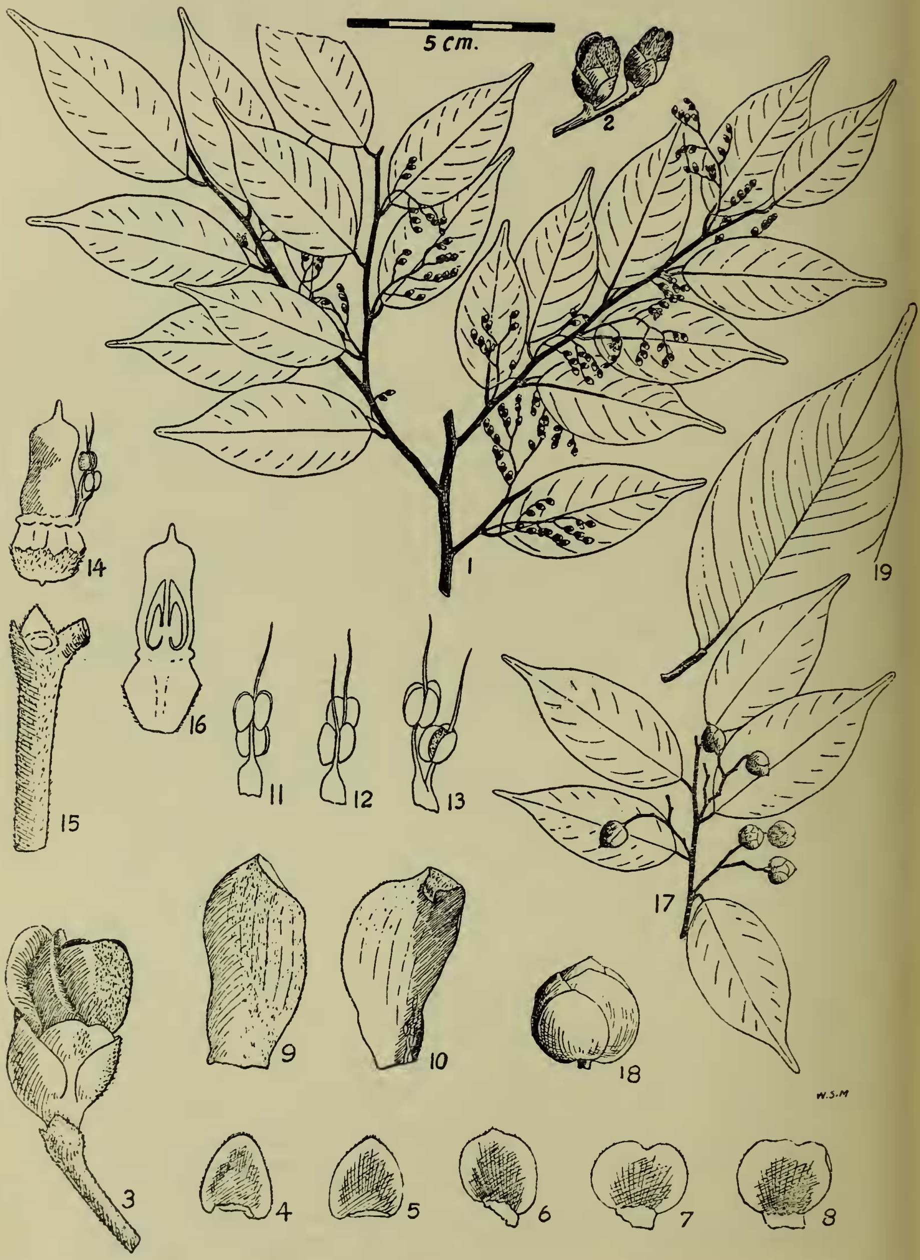
* For previous papers see *Gard. Bull. S.S.* Vol. VII, pp. 129–159 (1933), Vol. VIII, pp. 1–40 (1934) and 265–292 (1935), and Vol. IX, pp. 319–354 (1938).



*Hopea minima* Sym. var. *penangiana* Sym.

are left too long in obscurity, and it is therefore very desirable that the intelligent collection of such material should be encouraged.

The description of only three new Bornean species is given in this paper, namely *Shorea leptoclados, S. Flemmichii,* and *Dryobalanops Keithii.* Although little is offered for publication, the study of Bornean dipterocarps has made good progress during the year. For this we are particularly indebted to Messrs. H. G. Keith and C. O. Flemmich, the forest officers in North Borneo and Brunei, respectively. In addition to continuing to pursue their extremely energetic policy of collection of herbarium material, these gentlemen organized most interesting and comprehensive tours for me, on which I had the invaluable opportunity of studying the dipterocarps in the field.

Dr. van Slooten's visit to Kepong, during April, 1938, did much to stimulate systematic research on the dipterocarps, and his generosity in placing at my disposal the valuable early Dutch collections is greatly appreciated. I am also indebted to the Forest Botanist of the Forest Research Institute, Dehra Dun, for sending on loan his entire collections of *Shorea, Hopea,* and *Balanocarpus;* to the Director of the Forest Research Institute, Buitenzorg; and to numerous other botanists and forest officers whose assistance, if less spectacular, is no less valued.

These notes are arranged as in my previous papers, the concluding paragraph under each heading being a brief *précis* for the benefit of Malayan forest officers.

In previous papers, under citation of specimens, I have followed Foxworthy in prefixing numbers in the Federated Malay States Forest Department series with the letters "C.F." I propose, in future, to substitute for this prefix "Forest Dept. F.M.S." The original specimens in this series are, in all cases, preserved in the herbarium of Forest Research Institute at Kepong, for which I intend to employ the contraction "Kep." proposed by Lanjouw in *Chronica Botanica* 3: 347 (1937).

**Hopea minima** Symington, **nom. nov.** *Balanocarpus Curtisii* King in Journ. Asiat. Soc. Bengal 62: 131 (1893) et in Ann. Bot. Gard. Calcutta 5, pt. 2: 158, plate 191 a. (1896); Brandis in Journ. Linn. Soc. 31: 111 (1895) quoad speciminum penangiorum; Burkill in Journ. Str. Br. R. As. Soc. 81: 59, fig. 26–45 (1920); Ridley, Fl. Mal. Penins. 1: 246, fig. 23F. (1922). *Balanocarpus bracteatus* sensu Merr., Bib. Enum. Born. Pl. 407 (1921), et sensu Foxw., Mal. For. Rec. 10: 142 (1932) quoad synon. B. Curtisii; non Hopea bracteata Burck. **Plate 11.**

The earliest collections of this species were made by Kunstler (1882 and 1884) and Wray (1888) in Perak, and Curtis (1888 and 1893) on Penang Island. It was first described by King in 1893 who, in 1896, published a figure accompanied by an almost identical description. He named the species *Balanocarpus Curtisii.*

In 1895 Brandis united *B. Curtisii* with *Hopea bracteata* Burck (1887) from Borneo but, following the "Kew Rule", he retained King's name. The combination *Balanocarpus bracteatus* was made by Merrill in 1921 to conform with the "International Rules".

I do not agree with Brandis in this union. The flowers are, as he says, structurally almost identical, but they are more distinctly pedicellate and the panicle is very much more lax that any collection of *Hopea minima sensu lato.* Moreover, there is an undefinable difference in *facies*—they *look* different!

I have already* expounded my views on the generic affinities of this plant. It belongs to an as yet undefined group of *Hopea,* very closely allied to the section *Dryobalanoides* Miq., which is characterized by persistent, paired bracteoles on the inflorescence. To this group, which for convenience I shall call the *Bracteata* group, belong *Hopea bracteata* Burck, *H. Griffithii* Kurz, *H. nigra* Burck, *H. subalata* Sym., *H. nervosa* King, *H. sublanceolata* Sym., and some others.

While removing King's *Balanocarpus Curtisii* to the genus *Hopea,* a new name must be sought, because a *Hopea Curtisii* (synonym of *H. sangal* Korth.) already exists. *Hopea minima* seems appropriate for this small tree which, on Penang Island at any rate, never exceeds about 40 feet in height and may mature at a height of only 10 feet.

King has given quite adequate descriptions of this species, but he did not draw attention to the fact that there are two distinct forms. The collections from Penang differ from those from Perak and elsewhere on the mainland. The differences are slight, but so constant that specific separation might be considered justifiable. I think, however, that the best way to treat them is to constitute two varieties as follows—

Folia elliptico—lanceolata, basi subcuneata; ramuli petiolique fere glabri; paniculi densiflori .................................... var. **penangiana var. nov.**

Folia ovato-lanceolata, basi obtusa; ramuli petiolique puberuli; paniculi laxiores ...... var. **perakensis var. nov.**

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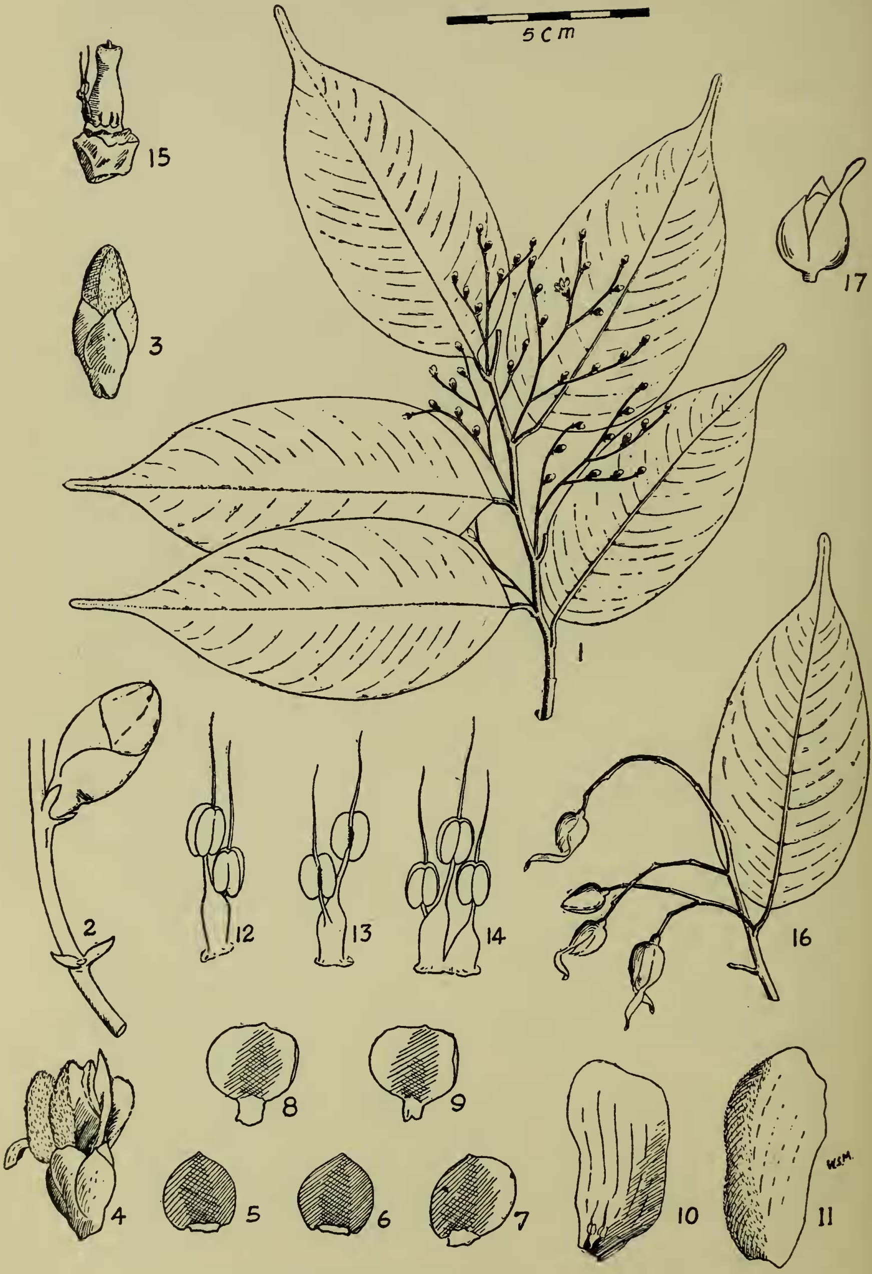
* *Gard. Bull. S.S.* 8: 26–29 (1934).



*Hopea subalata* Sym.

When describing *B. Curtisii,* King had before him flowering and fruiting material of both forms but, although he has taken the specific name from the collector of the Penang specimens and placed them first in his list of citations, his description and figure are apparently drawn mainly from the Perak collections of Kunstler and Wray. Also the figure published in the *Ann. Bot. Gard. Calc.* shows clearly the puberulous branchlet and lax panicle of the Perak form.

Collections examined:—

MALAY PENINSULA:

PENANG (var. *penangiana*): Curtis 1406 (flower, 1888) (Syntype of *Balanocarpus Curtisii* King and Type of *Hopea minima* var. *penangiana* Sym.); Curtis 1406 (fruit, 1893) and *s.n.* (flower, 1901).

Also—Ridl. *s.n.;* S'pore Field No. 3141, 3322, 3364, 3402, 3493, 3722, 3749; Forest Dept. F.M.S. 11657, 28022.

PERAK (var. *perakensis*): Wray 2860, Kunstler 3171, 3294 and 6543 (Syntypes of *Balanocarpus Curtisii* King. Wray 2860 may be taken as the Type of *Hopea minima* var. *perakensis* Sym.).

Also—Forest Dept. F.M.S. 175.

PAHANG: The following incomplete specimens exist: it is doubtful to which variety they belong—S'pore Field No. 16520; Forest Dept. F.M.S. 5088, 37320.

The species here renamed *Hopea minima* Sym. is a small, smooth-barked, stilt-rooted form of *merawan* which is best known from the vicinity of the Waterfall Gardens in Penang. Originally it was named *Balanocarpus Curtisii* by Dr. King. While transferring the species to *Hopea* a new name must be given, because a *Hopea Curtisii* already exists.

The species also occurs in Perak but the Perak specimens are considered to differ varietally from the Penang ones. Two varieties are therefore here described, var. *penangiana* Sym. from Penang, and var. *perakensis* Sym. from Perak.

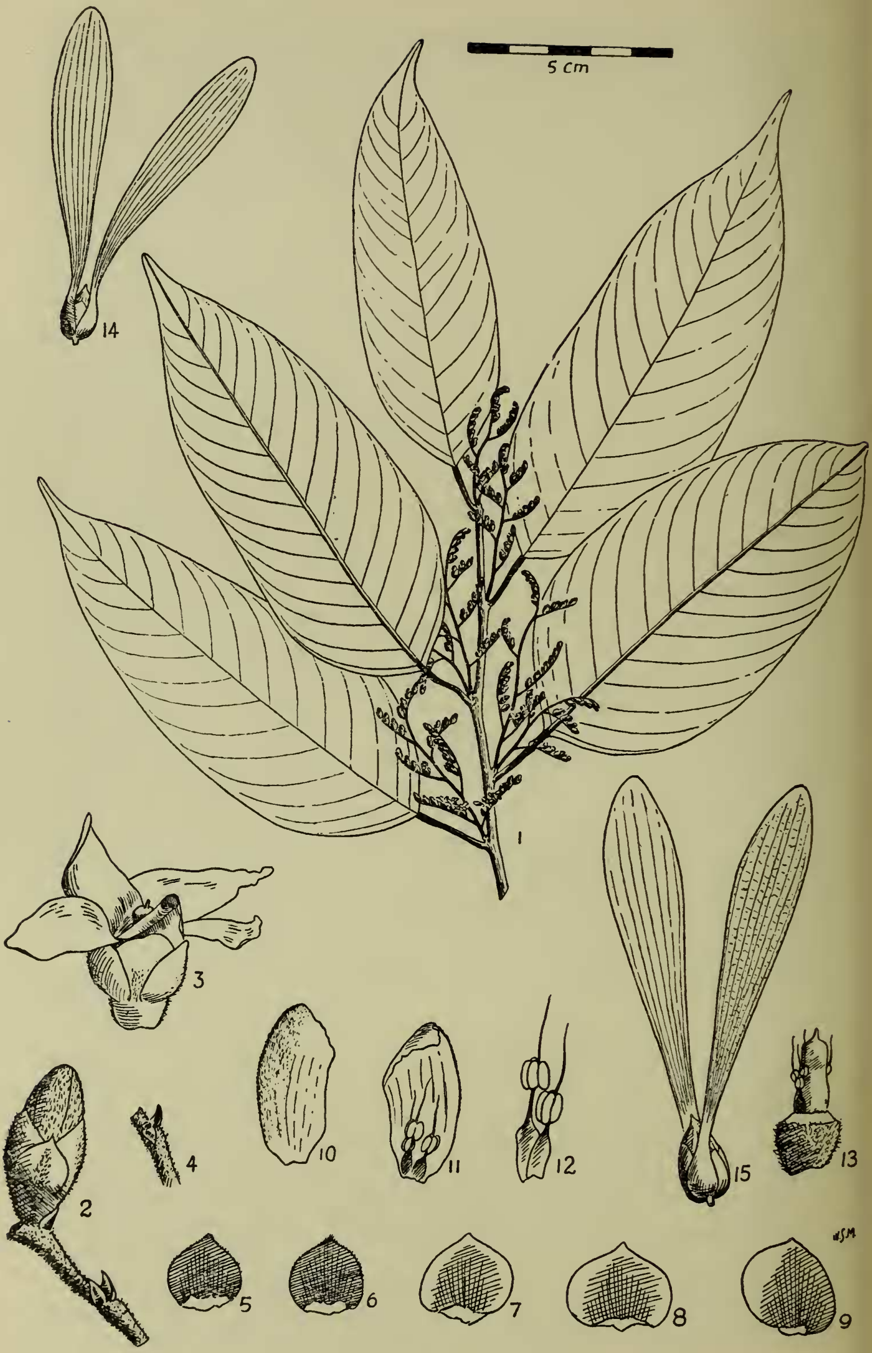
✓ **Hopea subalata** Symington, **sp. nov.** *Balanocarpus ovalifolius* sensu Foxw., Mal. For. Rec. 10: 143 (1932) partim; non B. ovalifolius Ridl. **Plate 12.**

H. minimæ Sym. valde affinis sed omnibus partibus majoribus, paniculis laxioribus satis distincta.

*Branchlets* rather fine, dark, puberulous towards the ends with short, prominent, decurrent leaf traces. *Leaves* oval to ovate, acuminate, about 9.0 cm. long (including the narrow, blunt acumen 1.5 cm. long) × 4.5 cm. broad, glabrous except for the midrib on the upper surface, drying pale grey-green above and darker beneath (both surfaces may have a silvery sheen due to the presence of minute silvery scales); midrib slightly depressed above but tomentose, prominent and glabrous beneath; main nerves about 10 to 13 pairs with occasional shorter intermediate nerves, inconspicuous above, fine but distinct beneath and sometimes with small tufted domatia in the axils of the lower ones; reticulations invisible to the naked eye; petioles about 5.0 mm. long, slightly channelled or subterete, tomentose or glabrescent. *Panicles* axillary towards the ends of the branchlets, in solitary (occasionally paired) racemes up to 6.0 cm. long; racemes glabrescent, dark-coloured when dry; branchlets about 2.0 cm. long, delicate, 2 to 5-flowered, subtended by caducous bracteoles. *Flowers* about 5.0 mm. apart and about 3.0 mm. long, each subtended by small, triangular, glabrous or ciliate, subpersistent, paired bracteoles; pedicel very short, glabrous. *Sepals* glabrous except for a few setæ on the exposed portions; two outer ovate-rotundate, blunt or acute at the apex; three inner broader than long, sinuate at the apex. *Petals* oblong, blunt, tomentose on the portions exposed in bud, purple (D.B. Arnot, Forest Dept. F.M.S. 13045). *Stamens* 15, arranged as in most species of *Hopea;* filaments broad at the base, narrowing abruptly to the filamentous upper portions; anthers 4-celled, cells subequal; appendage to connective filiform, slightly longer than the filament and anther. *Ovary* and stylopodium oblong, truncate, constricted in the upper portion, glabrous; apex of the stylopodium pellucid gland-dotted, forming a ring around a depressed portion in which is set the style; style short, oblong-conical; stigma minute. *Fruit* a wingless or shortly 1-or 2-winged nut, all parts glabrous; stalk short but prominent, about 1.0 mm. long; nut ovate-conical, shortly apiculate, about 1.3 cm. long, enclosed except towards the apex by the closely appressed bases of the calyx-lobes; calyx-lobes woody at the base, cemented together and to the nut by a sparse, resinous cement; one or both of the two outer lobes sometimes developed into short, rudimentary wings which occasionally exceed 1.0 cm. in length.

This species, which is known only from one locality in Selangor, was first collected in 1921. The specimens were in fruit: flowers were obtained in 1927. These fruiting specimens, and one other sterile specimen, were the basis of what Foxworthy called *Balanocarpus ovalifolius* Ridl. Ridley's species, however, as I have pointed out elsewhere [*Gard. Bull. S.S.* 8: 28 (1934)], has no real existence, being based on a mixture of *Hopea Beccariana* Burck and *Shorea Maxwelliana* King.

The only flowering collection (Forest Dept. F.M.S. 13045), which becomes the type of *H. subalata* Sym., was referred by Foxworthy to *Hopea intermedia* King.



*Hopea sublanceolata* Sym.

*H. subalata* is clearly a member of what I have called (*vide* p. 338) the *Bracteata* group. Its closest ally is probably *H. minima* Sym., but it differs in being larger in all parts and in having rudimentary wings. In this latter respect it is of particular interest because it exhibits a transition between the winged and wingless members of the group.

Collections examined:—

MALAY PENINSULA:

SELANGOR: Forest Dept. F.M.S. 13045 (Type of *H. subalata* Sym.); D.B. Arnot; Kanching Forest Reserve, Compt. 1; 9th August, 1927; flower. Field notes—"Tree, inflorescence purple".

Also—Forest Dept. F.M.S. 5796, 14901, 22074, 24921, 29770, 29831, 32376.

The species here described as *Hopea subalata* Sym. is a small, smooth-barked tree with pronounced stilt roots. It occurs in Compt. 1 of Kanching Forest Reserve in Selangor. No vernacular name is known but *merawan* or *merawan jangkang* would probably be given to it. In *Mal. For. Rec.* 10 this tree is confused with *Balanocarpus ovalifolius* Ridl.

√**Hopea sublanceolata** Symington, **sp. nov.** *H. nervosa* sensu Foxw., Mal. For. Rec. 10: 129 (1932) partim; non H. nervosa King. **Plate 13.**

*H. nervosae* King valde affinis sed paniculis petiolisque gracilioribus, foliis tenuioribus, nervis intermediis haud conspicuis differt.

*Branchlets* glabrous, pale towards the ends. *Leaves* lanceolate to ovate-lanceolate, caudate-acuminate at the apex, acute to shortly cuneate at the base, averaging about 12.0 × 4.3 cm., glabrous and usually drying pale greenish-yellow on both surfaces; midrib slightly depressed above, prominent beneath; main nerves about 15 pairs, very faint on the upper surface, fine but prominent on the lower, intermediate nerves absent or very faint; nervules joining the main nerves in fine wavy lines, hardly visible on either surface; petioles subterete, rather slender, about 1.5 cm. long, glabrous, drying black. *Panicles* axillary towards the ends of the branchlets, or terminal; racemes solitary or two (rarely three) together, up to 5.0 cm. long; sparsely cinereous pubescent towards the ends; ultimate branchlets up to 1.7 cm. long, 2 to 6-flowered, pubescent. *Flowers* secund, 1.0–1.5 mm. apart, about 3.0 mm. long in mature bud; pedicel very short, pubescent. *Sepals* puberulous on the outside; two outer broadly ovate; three inner slightly larger and broader, acute. *Petals* oblong, fimbriate at the apex, minutely tomentose on the portions exposed in bud, "corolla falling in one piece; petals deep, dark red with light tips" (Symington, 30808). *Stamens* 15, in three rows arranged as in most species of *Hopea;* filaments broad at the base, narrowing abruptly about the middle to the filamentous upper portion; anthers 4-celled, cells subequal; appendage to connective filiform, about as long as the filament and anther. *Ovary* and stylopodium broadly cylindrical, truncate, slightly constricted just above the middle, glabrous; style short, cylindrical; stigma minute. *Fruit* glabrous; stalk short; sepal bases very thick and woody; two large sepals spathulate, up to 10.0 × 2.0 cm. and 9-nerved but frequently much smaller; three small sepals closely appressed to the nut, without, or with only rudimentary, free portions; nut ovate-conical, up to 2.0 cm. long, shortly blunt apiculate, frequently shining with a resinous coating, closely embraced in the lower half by the imbricate sepal bases.

Several collections of this species have been made in the Malay Peninsula since 1920. In 1932 Foxworthy referred five of these collections (S'pore Field No. 6929; Forest Dept. F.M.S. 10377, 12192, 8818, 12070) to *Hopea nervosa,* with which species they are certainly closely related. Both species belong to the *Bracteata* group (*vide* p. 338) and both have unusually large leaves and fruits. The chief distinguishing characters are these:—

*H. sublanceolata*—buttresses not, or inconspicuously, stilted; twigs light-coloured when dry; petioles about 1.5 cm. long, slender, drying black; leaves lanceolate or ovate-lanceolate, acute or shortly cuneate at the base; intermediate nerves absent or very faint; panicles with 2 to 6 flowers per branchlet.

*H. nervosa*—buttresses usually markedly stilted; twigs dark or pale lepidote; petioles coarser, about 1.0 cm. long, frequently pale lepidote; leaves usually oblong or elliptic-oblong, usually rounded at the base; intermediate nerves frequently present and conspicuous; panicle branchlets with not more than 4 flowers.

Collections examined:—

MALAY PENINSULA:

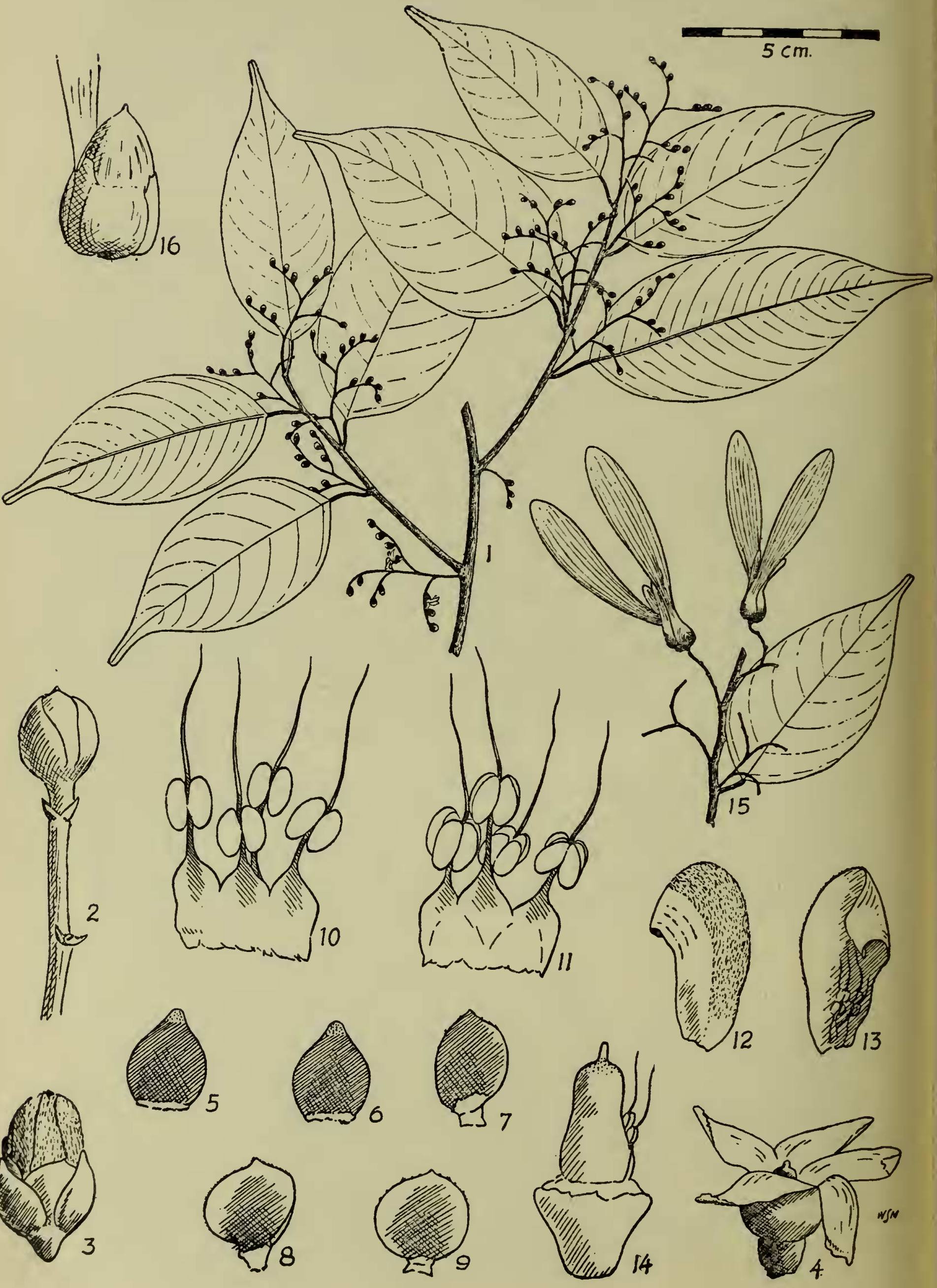
KEDAH: Forest Dept. F.M.S. 42292.

PERAK: Forest Dept. F.M.S. 30808 (Type of *H. sublanceolata* Sym.); C.F. Symington; Sumpitan, Upper Perak, low-lying land; 6th April, 1933; flower. Field notes—"Tree 3 ft girth; coarse *jangkang* habit not very obvious; bark flaking in small scales; small exudations of clear damar from bole; inner bark slightly pink; corolla falling in one piece; petals deep dark red with light tips".

Also—Forest Dept. F.M.S. 8818, 10377, 12070, 12192, 30342, 30804, 39151; S'pore Field No. 6929.

KELANTAN: Forest Dept. F.M.S. 29119, 32845, 33260.

PAHANG: Forest Dept. F.M.S. 40420.



*Hopea Griffithii* Kurz.

*Hopea sublanceolata* is a large-leaved *Hopea* which occurs mainly in the north of the Peninsula and in Temerloh District of Pahang. It has rather an unusual bole which has been described as resembling *petaling* (Ochanostachys amentacea), and in Perak North it has been called *jerawai*. The leaves resemble those of *Hopea nervosa* (merawan jangkang) with which species it was formerly confused.

**Hopea Griffithii** Kurz in Journ. Asiat. Soc. Bengal 42, pt. 2: 60 (1873) et For. Fl. Brit. Burma 1: 122; Dyer in Hook. f. Fl. Brit. Ind. 1: 310 (1875); Brandis in Journ. Linn. Soc. (Bot.) 31: 69 (1895) var. pedicellata excl., et Indian Trees: 68 (1911); Sym. in Gard. Bull. S.S. 9: 324 and 329 (1938) in obs. *Hancea Griffithii* (Kurz) Pierre, Fl. For. Cochinch. 4 (1891) in nota sub t. 248. *Hopea Pierrei* sensu Ridl., Fl. Mal. Penins. 1: 238 (1922) partim; non H. Pierrei Hance. **Plate 14.**

*Branchlets* rather fine, glabrous, usually drying dark purple or black. *Leaves* ovate to ovate-lanceolate, caudate-acuminate at the apex, subacute to rounded at the base, averaging about 7.0 × 3.5 cm. on Malayan specimens but considerably variable, glabrous, drying grey-brown on the upper surface and dull purple-brown on the lower; midrib slightly depressed above, elevate beneath; main nerves 10 to 14 pairs with 1 to 3 shorter intermediate nerves between each, usually invisible above, faint and hardly elevate on the lower surface; reticulations invisible to the naked eye; petioles slender, about 0.5–1.0 cm. long, glabrous, drying black. *Panicles* axillary towards the ends of the branchlets, or terminal; racemes solitary or paired, usually less than 3.0 cm. long, glabrous, drying black; branchlets about 0.4 cm. apart, up to 1.5 cm. long, 2 to 5-flowered, subtended by caducous bracteoles. *Flowers* about 3.0 mm. apart, about 3.0 mm. long in mature bud, each subtended by minute, triangular, glabrous, black, persistent, paired bracteoles; pedicel very short, glabrous. *Sepals* drying black; two outer ovate, obtuse, glandular at the apex; three inner subrotundate, shortly acuminate, ciliate along the upper margins. *Petals* oblong, tomentose on the portions exposed in bud, red (Ridley). *Stamens* 15, in three rows arranged as in most species of *Hopea;* filaments broad in the lower half, narrowing abruptly to the filamentous upper portion; anthers 4-celled, cells subequal; appendage to connective filiform, as long as the filament and anther. *Ovary* and stylopodium broadly cylindrical, slightly constricted just above the middle, glabrous, gland-dotted at the apex; style short, cylindrical; stigma minute. *Fruit* glabrous; stalk very short, attached at a concavity formed by the woody bases of the sepals; two large, accrescent sepals spathulate, blunt, up to 5.0 × 1.2 cm., woody at the base, chartaceous on the free portions, about 9-nerved; three small sepals oblong, blunt, hardly enlarged beyond the nut, or up to 1.0 cm. long; nut ovate-conical, shining, surmounted by a short blunt apicula, embraced in the lower half by the closely appressed, imbricate sepal bases.

*Hopea Griffithii* was briefly described by Kurz in 1873 from a flowering collection made by Griffith in Mergui, Tenasserim. In 1875 Dyer improved slightly on Kurz's description by describing the floral bracteoles.

Brandis, in 1895, was the first materially to alter the circumscription of the species. He included four additional collections (Ridley, Singapore; Curtis 167, Penang; Forbes 3205 and 3208, Sumatra), and amended the specific description to admit them. Ridley's Singapore collection is presumably No. 4738 of which sheets are preserved at Kew, Leiden, Singapore, and Buitenzorg. This collection has broader leaves than the Burmese type of *H. Griffithii* but the texture of all parts, and the floral structure, are identical. Ridley referred it to *H. Pierrei,* but the shape of ovary denies this possibility and I consider that Brandis was correct in referring it to *H. Griffithii.*

The collections of Curtis and Forbes, which Brandis cited, were made the basis of his variety *pedicellata.* These collections have a similar stylopodium to *H. Griffithii* but, as I have stated in *l.c.,* they differ markedly in other respects and should be kept specifically distinct. I have made Curtis 167 the basis of *H. pedicellata* (Brandis) Sym.

*Hopea Griffithii* is clearly a member of the *Bracteata* group (*vide* p. 338).

Collections examined:—

BURMA:

TENASSERIM: Griffith 717 (Iso-holotype of *H. Griffithii* Kurz in Herb. Kew).

MALAY PENINSULA:

KELANTAN: Forest Dept. F.M.S. 29128, 32742, 33437, 37846, 37850, 37972.

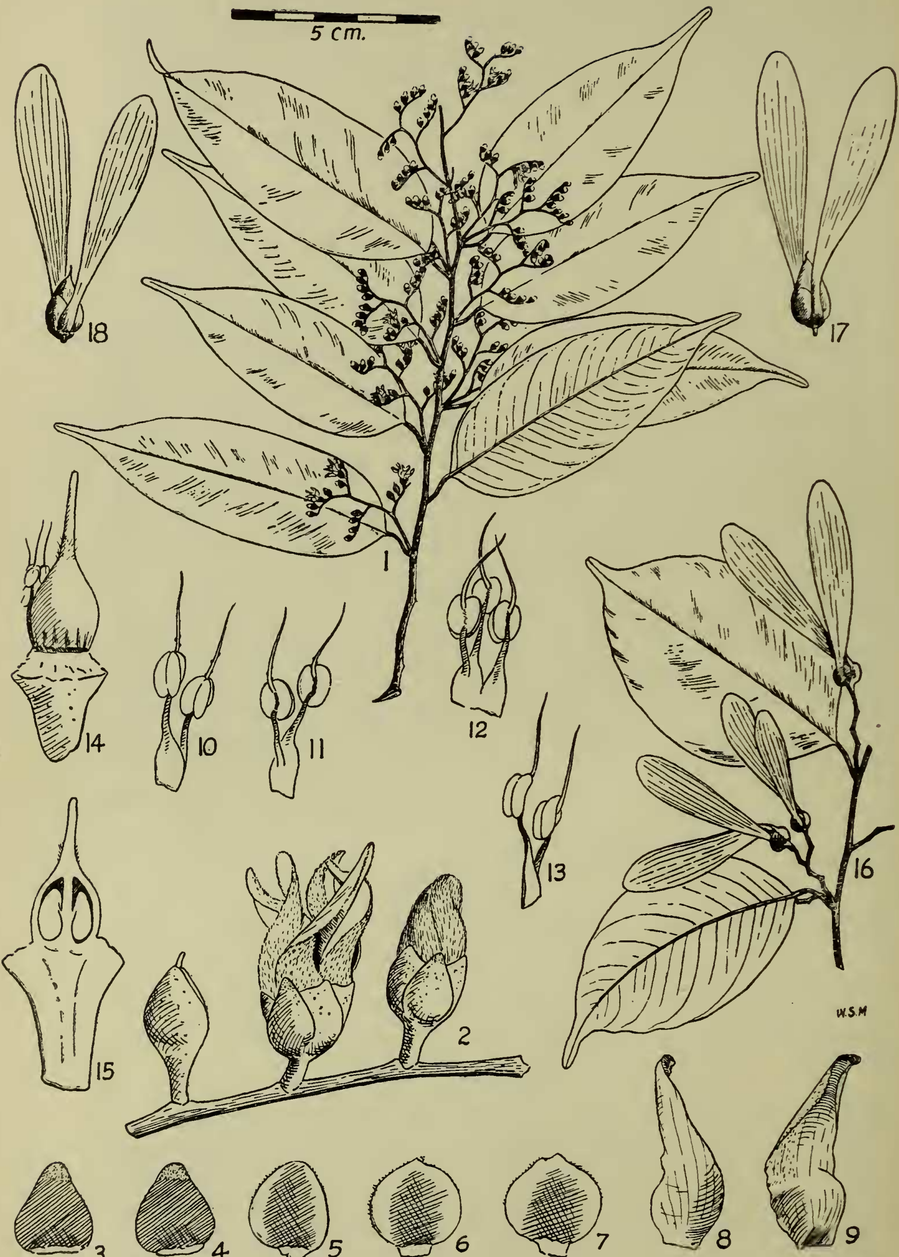
TRENGGANU: Forest Dept. F.M.S. 26705, 26906.

PAHANG: Forest Dept. F.M.S. 15635, 17402, 31674, 43132.

JOHORE: Forest Dept. F.M.S. 45944, 45949.

SINGAPORE: Ridley 4738 (? Herb. Lugd. Bat. 902146, 377 and 378), Ridley 5093, Mohd. Nur. *s.n.* (Gardens' Jungle, 5th Oct. 1920).

*Hopea Griffithii* is a form of *merawan* originally described from Burma. It was collected in the Botanic Gardens' Jungle, Singapore in 1893, but botanists have disagreed concerning the identity of the Singapore tree. It is here concluded that the Singapore collection is conspecific with the type of *H. Griffithii.* The species occurs throughout the east of the Malay Peninsula, from Kelantan to Singapore.



*Hopea dryobalanoides* Miq.

√ **Hopea dryobalanoides** Miq., Fl. Ind. Bat. Suppl.: 492 (1860); Scheff. in Nat. Tijdschr. N.I. 31: 351 (1870); Burck in Ann. Jard, Bot. Buitenz. 6: 240 (1887); King in Journ. Asiat. Soc. Beng. 62, pt. 2: 125 et 126 (1893) in notæ; Brandis in Journ. Linn. Soc. (Bot.) 31: 69 (1895); Boerlage, Cat. Hort. Bogor. 104 (1901); Heyne, Nutt. Plant. Ned. Ind. 1107 (1927) in nota; Endert in Tectona 28: 248-311 passim (1935); Rappard in Tectona 30: 897–913 passim (1937). √*?Hopea sarawakensis* Heim (**syn. nov.**) in Bull. Soc. Linn. Paris 2: 971 (1891); Brandis in l.c. 69 (1895). *Hopea micrantha* sensu King in l.c. 126, in nota; sensu Foxw., Mal. For. Rec. 10: 135 (1932) partim; non H. micrantha Hook. f. **Plate 15.**

*Branchlets* dull reddish-or grey-brown, more or less lenticellate. *Leaves* usually elliptic to oblong-lanceolate, rather variable, bluntly caudate-acuminate at the apex, slightly unequal at the base, usually rounded on one side and acute on the other, average size about 7.5 × 2.75 cm., glabrous on both surfaces; usually drying dull grey-or yellow-brown above, slightly darker but shining on the lower surface; midrib slightly raised on the upper surface, rather sharply keeled beneath; main nerves about 12 pairs with 1 to 3 hardly less prominent intermediary nerves between each, slightly depressed but inconspicuous on the upper surface, hardly elevated but clearly defined and usually light yellow on the lower surface, occasionally with hairy domatia in their axils; reticulations hardly visible to the naked eye; petioles about 8.0 mm. long, slightly thickened in the upper portion, glabrous; stipules minute, caducous. *Panicles* terminal and axillary towards the ends of the branchlets; racemes usually solitary but occasionally paired, short, rarely exceeding 3.0 cm. in length or with more than 6 alternating branchlets; branchlets about 13.0 mm. long or less, 2 to 6-flowered, the flowers about 2.0 mm. apart. *Flowers* subovate in bud, pedicellate, about 4.0 mm. long (including the pedicel); pedicel about 1.0 mm. long, apparently glabrous at low magnifications. *Sepals:* two outer ovate, thick, puberulous outside, tomentose at the apex on both surfaces; three inner subrotundate, thinner, puberulous outside and fringed with minute hairs. *Petals* linear-oblong, slightly fimbriate at the apex, tomentose on the portions exposed in bud, creamy white to pale yellow in the throat of the corolla (Symington). *Stamens* 15, arranged in the manner usual in this group; filaments broad and flattened at the base, narrowing in the upper half (abruptly in mature stamens), 2 to 3 times as long as the anthers; anther cells subequal; appendage to connective filiform, about as long as the filament, sometimes sparsely glandular-tuberculate.

*Ovary* ovate-conical, glabrous, narrowing gradually to the style; style cylindrical-filiform, about as long as the ovary, glabrous or furnished with a ring of minute hairs at the base*; stigma minute. *Fruit* shortly but conspicuously stalked, glabrous; calyx-lobes thickened and woody at the base, closely embracing the lower portion of the nut and cemented to it by a resinous exudation; two long wings spathulate, up to 6.0 × 1.3 cm. but frequently shorter and narrower, about 7-nerved; three lobes obtuse at the apex and only ½ the height of the nut; nut ovate-conical, pointed (the style sometimes persists as an awn-like apiculus until maturity), up to 13.0 × 9.0 mm. when mature, free on the upper half.

*Hopea dryobalanoides* was described by Miquel, in 1860, from two collections made by Teysmann in East Sumatra. The Priaman specimen consists of fragmentary immature fruit, twigs, and leaves: the Sungei Pagu specimen has leafy twigs only. In 1887 Burck stated that the two collections represented different species, the Sungei Pagu one being *H. mengarawan* Miq.** He states that the fruits described by Miquel under *H. dryobalanoides* are *H. mengarawan:* but the fruits accompany the Priaman specimen, not the Sungei Pagu one!

King accepted Burck's opinion concerning the mixed nature of Miquel's species. In 1893 he suggested that *H. micrantha* Hook. f. (or what he thought was *H. micrantha* Hook. f.!) was *H. dryobalanoides* Miq. *emend.* Burck, but concluded that, because of the supposed mixed nature of Miquel's species and the lack of flowers, it should be suppressed as a species.

King's suggestion apparently did not find support from Dutch botanists. In 1901 Bœrlage appears to have, rightly in my opinion, considered both Teysmann's original collections of *H. dryobalanoides* as conspecific, and with them identified tree number VII. B. 23, cultivated in the Botanical Gardens, Buitenzorg.

Although there are no important references to *H. dryobalanoides* in subsequent systematic works, and the species has never been adequately described, it is mentioned frequently in forestry literature of the Netherlands Indies as one of the main producers of high quality damar (*damar mata kuching*).

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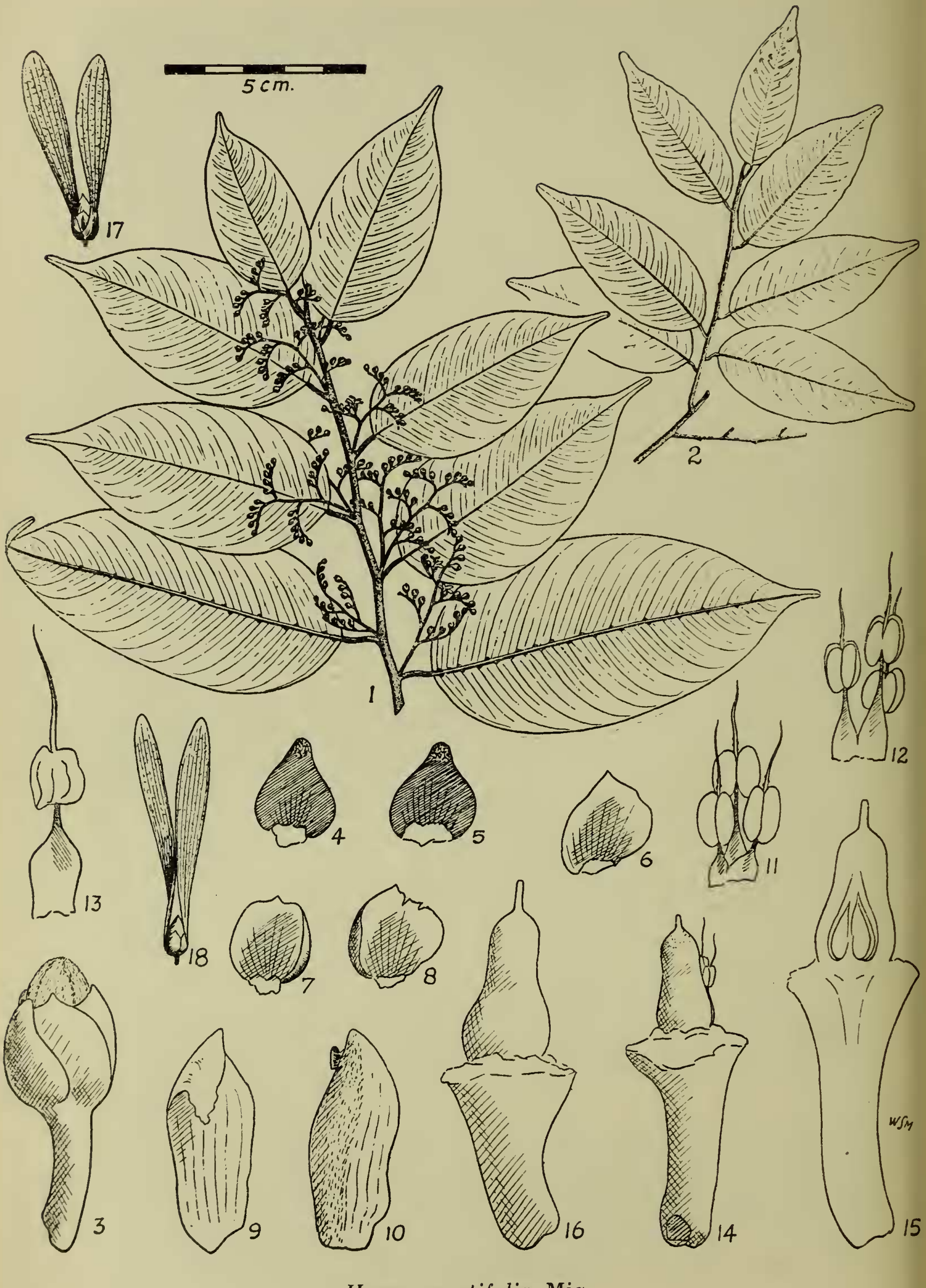
* The presence or absence of this hairy ring is fairly constant in any given specimen, although the hairs are less evident in mature flowers than in young buds, but varies between collections: *e.g.* Forest Dept. F.M.S. 623 and 2121 have a distinct ring, Forest Dept. F.M.S. 17326 has traces of a ring only in young bud, while Forest Dept. F.M.S. 30912 and H.B. 938.12.5*b* have no hairs.

** King considered the same collection to be *Hopea micrantha* Hook.f.



*Hopea myrtifolia* Miq.

In 1891, Heim described a Bornean collection of Beccari as *H. sarawakensis*. The specimen has only immature fruits but, in my opinion, does not differ in any essential from *H. dryobalanoides* Miq. Actually when describing the species Heim stated that "*Cette espêce ne peut en l'absence de l'anatomice, être qu'imperfaitment differencée de l'* Hopea borneensis".

*H. dryobalanoides* has been collected from time to time in the Malay Peninsula, but no specific name was put to the specimens until Foxworthy, in 1932, referred them, along with some of *H. sulcata* Sym., to *H. micrantha.*

Collections examined:—

MALAY PENINSULA:

Kelantan: Forest Dept. F.M.S. 32832.
Perak: Forest Dept. F.M.S. 30912.
Selangor: Forest Dept. F.M.S. 729, 13280, 24007, 24085, 29745.
Negri Sembilan: Forest Dept. F.M.S. 625, 2110, 2121, 2123, 2147, 23794, 46106.
Pahang: Forest Dept. F.M.S. 10606, 17304, 17305, 17326, 17345, 45017.
Singapore: ? S'pore Field No. 2879 (fruits only).

SUMATRA: Teysmann *s.n.* (H.B. 587; 938.12.2: Utrecht 035932) Sungei Pagu (Syntype of *H. dryobalanoides* Miq.) and Teysmann *s.n.* (H.B. 938.12.4). Teysmann *s.n.* (H.B. 2073; 938.12.3: Utrecht 035933) Priaman (Syntype of *H. dryobalanoides* Miq.). Herb. De Vriese No. 26 (Herb. Lugd. Bat. 902144, 382).

Also—Heyne's native collector *s.n.* and bb. 21535 (Bengkulen).

JAVA: H.B. 938.12.5 (Cult. VII. B.23); H.B. 6515 (Cult. ex Bangka).

BORNEO:

Sarawak: Beccari 2897 (Iso-holotype of *H. sarawakensis* Heim in Herb. Kew). S'pore Field No. 36108 (= Forest Dept. Sarawak A0658).
West Borneo: *bb.* 17519 and *bb.* 21687.

The specific identity of the forms of *Hopea* producing *damar mata kuching* in the Malay Peninsula has long been in doubt. It is here shown that one of these species is *H. dryobalanoides* Miq. which has for many years been recognized as a source of high grade damar in the Netherlands Indies.

**Hopea myrtifolia** Miq., Fl. Ind. Bat. Suppl. 493 (1860); Scheff. in Nat. Tijdschr. N.I. 31: 351 (1870); Burck in Ann. Jard. Bot. Buitenz. 6: 242 (1887); Brandis in Journ. Linn. Soc. (Bot.) 31: 71 (1895) quoad spec. Teysm.; ? Heyne, Nutt. Plant. Ned. Ind. 1107 (1922) in nota; non sensu Endert in Tectona 28: 248–311 passim (1935). **Plate 16.**

*Branchlets* grey-brown, covered with a close, soft, fulvous-grey tomentum towards the ends. *Leaves* ovate-oblong, with a short blunt acumen at the apex, rounded at the base or sometimes slightly unequal with one side subacute, from 4.5 × 2.4 cm. or less to 10.0 × 5.0 cm., glabrous except for the midrib, usually drying dull grey-green on the upper surface and yellow-brown on the lower; midrib slightly raised and tomentose above, prominent but glabrous beneath; main nerves about 12 pairs, separated from one another by intermediary nerves some of which are almost as long and prominent as the main nerves, hardly visible above, faint but visible on the lower surface, sometimes with a few tufted domatia in their axils; reticulations hardly visible to the naked eye; petioles 4.0–10.0 mm. long on mature leaves, densely tomentose; stipules not seen. *Panicles* terminal and in the axils of the upper leaves; racemes solitary or paired, 5.0 cm. long at most, usually with 5 to 7 alternating branchlets; branchlets about 4.0 mm. apart, the longest about 1.5 mm. long with 6 secund flowers about 2.0 mm. apart. *Flowers* about 5.0 mm. long including the pedicel; pedicel 2.0 mm. long, glabrous. *Sepals* furnished with minute waxy scales outside; two outer broadly ovate, thick, with waxy masses in the apical portions on the inner side; three inner sepals subrotundate, pointed or subfimbriate at the apex, glabrous inside. *Petals* oblong-linear, fimbriate towards the apex, tomentose on the portions exposed in bud. *Stamens* 15, arranged in the manner usual in this group; filaments broad and flattened at the base, narrow in the upper portion; anther cells subequal; appendage to connective about as long as the filament, sometimes sparsely furnished with a few small glandular tubercles. *Ovary* in shape intermediate between the *H. Pierrei* and *H. pedicellata* types, minutely gland-dotted; style short, cylindrical, erect; stigma minute. *Fruit* entirely glabrous: stalk short but prominent, about 1.5 mm. long; calyx-lobes woody at the base, closely appressed to the lower half of the nut; two outer lobes wing-like, very narrow near the base, broad above, about 4.5 × 0.9 cm., about 8-nerved, thin and papery; three inner lobes broad, irregular at the apex, about half as high as the nut; nut ovate-conical, about 9.0 × 7.0 mm., crowned by a short but prominent sharp apiculus, more or less resinous.

*Hopea myrtifolia* was described by Miquel in 1860 from a collection made by Teysmann at Kebang, Lampong, Sumatra. The material, which consists of sterile immature branchlets, is represented by one sheet in the Utrecht Herbarium (Utrecht 035927) and two in the Buitenzorg herbarium (one of which is marked H.B. 4321). The Utrecht sheet bears a larger branchlet with some leaves more mature than those on the Buitenzorg sheet.

In view of the unsatisfactory nature of the type material it is not surprising that the species has remained in comparative obscurity. The only additional collection cited in botanical literature is Beccari 3021, which Brandis considered to be *H. myrtifolia.* In this he was obviously wrong; Becc. 3021 represents an undescribed species related to *H. bracteata* Burck.

*H. myrtifolia* is mentioned in the forestry literature of the Netherlands Indies as one of the main sources of high grade damar. This may be the case, and if my interpretation of the species is correct, *H. myrtifolia* does produce a high grade damar, but there is no evidence that, when speaking of *H. myrtifolia,* Dutch forest officers have had this species in mind. Indeed the only herbarium material from the N.I., that I have seen identified as *H. myrtifolia,* has been what I consider to be *H. ferruginea* Parijs.

We have only a few collections of *H. myrtifolia* from the Peninsula. One was made in 1919 but the rest are quite recent. To identify these with Teysmann's sterile immature specimens may seem rather rash, but there is such a marked similarity in shape of leaves, and texture and tomentum of all parts, that I feel reasonably confident about it. Some of our collections of slightly immature leaves are an excellent match for the more mature portions of Teysmann's type collection.

*Hopea myrtifolia* is undoubtedly very closely related to *H. pedicellata* (Brandis) Sym., which differs only in the more abruptly truncated stylopodium, the longer and narrower leaves, and the less tomentose branchlets. Detached mature leaves may be almost indistinguishable.

Collections examined:—

MALAY PENINSULA:

PERAK: Forest Dept. F.M.S. 4553, 28623, 31042, 31087, 33915, 41909, 41911, 41915, 43367, 44992, 47301, 47305, 47307, 47309.

PAHANG: Forest Dept. F.M.S. 41016.

NEGRI SEMBILAN: Forest Dept. F.M.S. 46071.

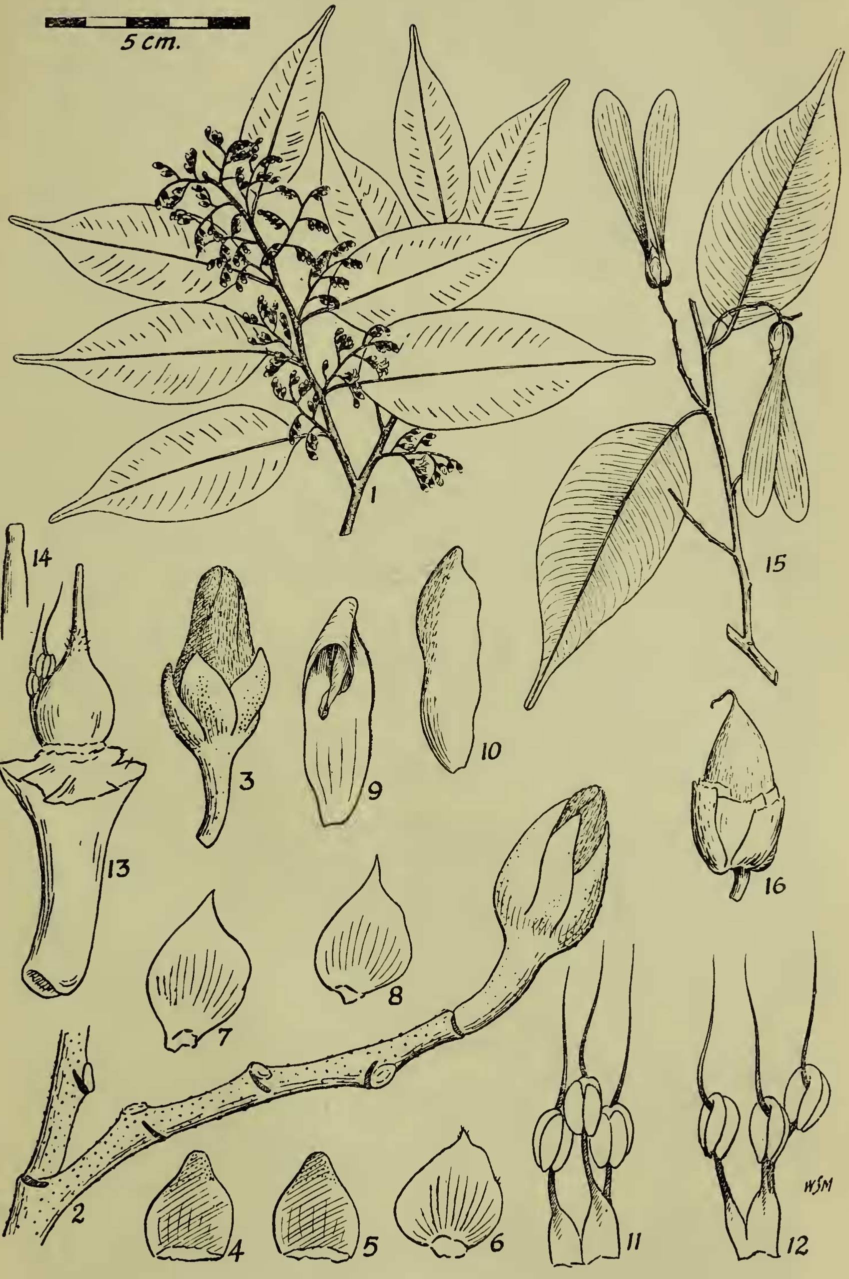
SUMATRA:

LAMPONG: Teysmann *s.n.* Kebang (H.B. 4321 and 938. 12.15, and Utrecht 035927: Holotypes of *H. myrtifolia* Miq.).

*Hopea myrtifolia* Miq. is a form of *merawan* producing *damar mata kuching.* It was originally described from sterile, immature material collected in Sumatra and its identity has been obscure: it is here identified with an hitherto unidentified tree which has been collected in Chikus and Bikam forest reserves in Perak, at Kuala Sungei Tahan in Pahang, and in Pasoh Forest Reserve in Negri Sembilan.

√**Hopea ferruginea** Parijs in Fedde Repert. 33: 243 (1933). *H. micrantha* sensu Dyer in Hook. f. Fl. Brit. Ind. 1: 310 (1874) partim, quoad spec. Maing.; sensu King in Journ. Asiat. Soc. Bengal 62, pt. 2: 124 (1893) partim, quoad Maing. 210; sensu Brandis in Journ. Linn. Soc. (Bot.) 31: 70 (1895) partim; sensu Ridl., Fl. Mal. Penins. 1: 237 (1922) partim; sensu Foxw., Mal. For. Rec. 2: 167 (1922) in nota, et Mal. For. Rec. 10: 136 (1932) partim; sensu Buckley, Mal. For. Rec. 11: 21 (1932) in nota; non H. micrantha Hook. f. *H. myrtifolia* sensu Heyne, Nutt. Plant. Ned. Ind. 1107 (1922) in nota (?); sensu Endert in Tectona 28: 248–311 passim (1935); non H. myrtifolia Miq. *H. intermedia* sensu Foxw., Mal. For. Rec. 3: 74 (1927) et Mal. For. Rec. 10: 134 (1932) partim; non H. intermedia King. *H. Pierrei* sensu Foxw., Mal. For Rec. 10: 133 (1932) quoad Holmb. 820; non H. Pierrei Hance. **Plate 17.**

*Branchlets* slender, with rather prominent decurrent leaf traces, silvery to ferruginous scurfy-tomentose towards the ends, later becoming glabrous, dark, and lenticellate. *Leaves* elliptic-lanceolate to subovate, caudate-acuminate at the apex, slightly unequal, acute to rounded and sometimes reflexed at the base, about 6.0 × 2.5 cm. but rather variable, glabrous (except for the midrib) on both surfaces but more or less covered with a minute silvery scurf, usually drying dull grey-green or silvery on the upper surface and yellow- or reddish-brown on the lower; midrib elevate and more or less tomentose on the upper surface, slightly keeled and glabrous on the lower; main nerves 12 to 16 pairs, separated by slightly shorter and hardly less prominent intermediate nerves, almost invisible on the upper surface, faint and hardly elevate on the lower, occasionally with tufted domatia in the axils of nerves near the centre of the leaf; petioles about .6 cm. long, fulvous or ferruginous-tomentose; stipules minute, caducous, *Panicles* axillary or terminal, tomentose or sparsely minutely hairy, of solitary racemes up to 3.0 cm. long; ultimate branchlets up 9.0 mm. long (usually about 5.0 mm.), 2 to 7-flowered. *Flowers* about 1.0 mm. apart, secund, about 3.0 mm. long and ovate-oblong in mature bud; bracteoles caducous; pedicel slender, about 1.0 mm. long, glabrescent. *Sepals:* two outer subovate, blunt and thickened at the apex. sparsely squamulose to densely squamulose-tomentose at the apex outside, squamulose at the apex inside; three inner subequal in height or slightly taller than the outer ones, broader and thinner, acute or acuminate and sparsely setulose at the apex. *Petals* linear-oblong, slightly fimbriate at the apex, sericeous on the portions exposed in bud, pale yellow. *Stamens* 15, arranged in the usual manner for this group; filaments broad at the base, narrowing about the middle to the filamentous upper portion; anthers 4-celled, the anterior cells slightly smaller than the posterior; appendage to connective filiform, as long as the filament and anther. *Ovary* ovate, narrowing



*Hopea ferruginea* Parijs

at the apex to the style, glabrous but for a ring of setose hairs at the base of the style*, style erect, cylindrical, about as long as the ovary, glabrous but for the setæ at the base; stigma minute. *Fruit* glabrous; stalk prominent, about 1.0 mm. long; two outer calyx-lobes developed into wings, about 4.0 × 0.8 cm., narrow towards the woody base, chartaceous, about 7-nerved; three inner lobes not enlarged beyond the apex of the nut; nut ovate-oblong, about .8 cm. long, surmounted by the thin, usually bent (frequently broken) remnant of the style, sometimes coated with a resinous cement, embraced except on the upper third by the inner calyx-lobes.

The earliest preserved collections of this species appear to be those made by Maingay in Malacca, in 1867. Two collections were made—no. 1203 on 22nd April, and no. 1394 on 25th May—but both were given the Kew Distribution number 210. In the *Flora of British India* (1874) these collections were enumerated under *Hopea micrantha* Hook. f. which had been previously described from Borneo, and this interpretation has mainly been followed by subsequent authors on the flora of the Malay Peninsula, although there has been much, and varied, confusion of this species with others.

In 1893, King included Maingay's collections in his *H. micrantha,* which is a mixture of *H. ferruginea* Parijs, *H. pedicellata* (Brandis) Sym., and *H. Dyeri* Heim. In 1895, Brandis excluded from *H. micrantha* most of King's Peninsular citations, but continued to include Maingay 210, and added Cantley 12, another collection of *H. ferruginea* made about 1880.

Ridley (1922) cited collections of *H. ferruginea* made by Maingay, Cantley, and Goodenough, under *H. micrantha,* but included specimens of *H. pedicellata* (Brandis) Sym. and *H. Dyeri* Heim along with them. In 1932, Foxworthy cited several additional collections of *H. ferruginea,* some under *H. intermedia* and some under *H. micrantha,* both of which, however, include collections of other species. He also cited Holmberg 820 under *H. Pierrei.*

Although this tree has never been properly understood botanically, it has aroused the interest of forest officers from time to time because it produces a high grade damar. It is mainly to this species that the reference to *damar mata kuching* in *Mal. For. Rec.* 2: 167 (1922), 10: 116 and 136 (1932), and 11: 21 (1932) apply.

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* This setose ring of hairs is very variable: in some specimens it is broad, while in others it is reduced to a few hairs, or may be entirely absent. The condition of the ring does not appear to be dependent upon the age of the flower.

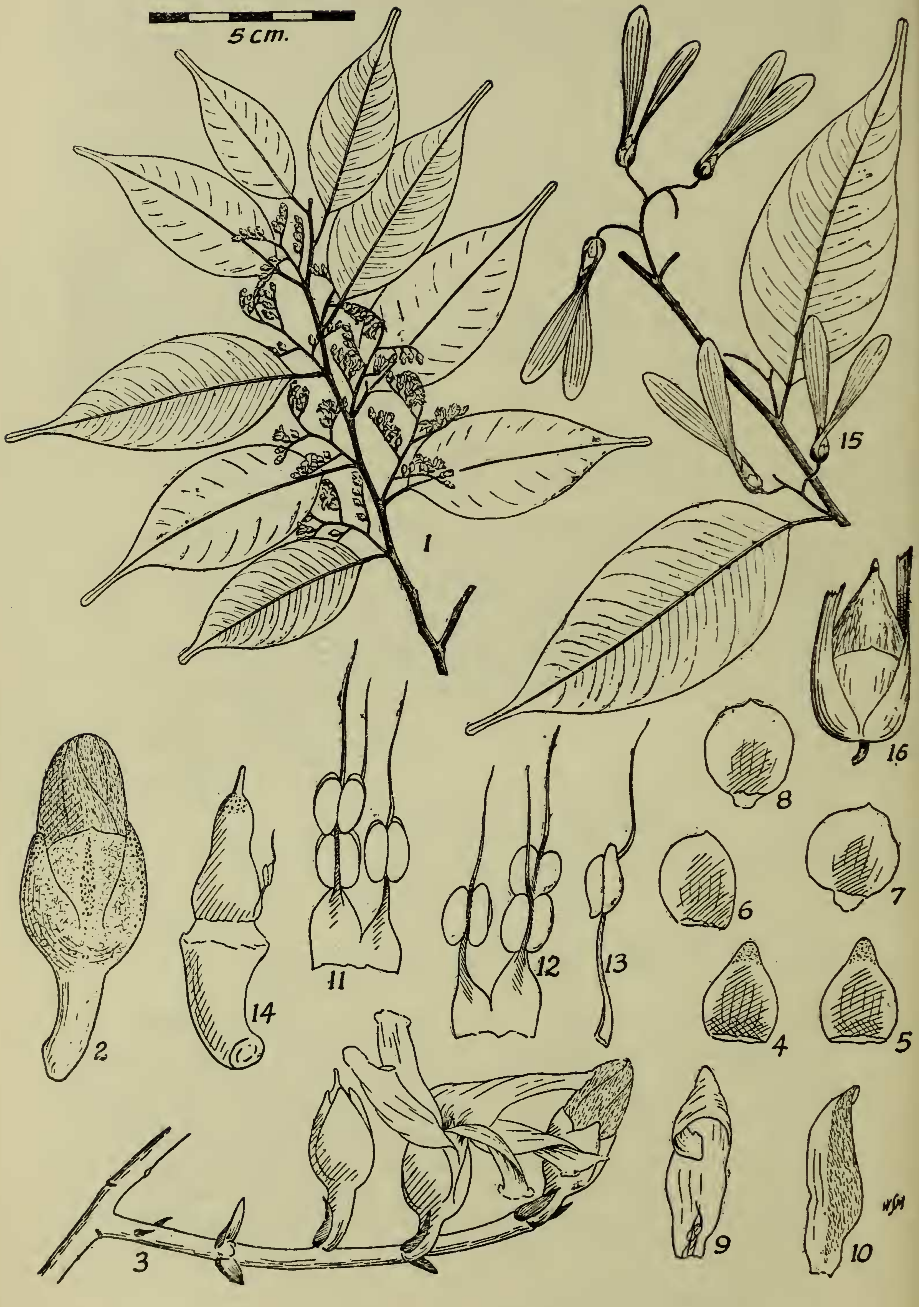
I can find no definite references to the species previous to 1933 in the botanical literature of the Netherlands Indies, but numerous collections have been made by the Forest Department of the Netherlands Indies since 1915. Some of these have been identified in manuscript with *H. micrantha* Hook. f., *H. Pierrei* Hance, or *H. myrtifolia* Miq., and economic notes concerning *"damar mata koetjing"* in the literature of the Forest Department under these names are probably mainly referable to this species.

It was in connection with the chemical study of a damar sample that the species received the name *Hopea ferruginea* Parijs (1933). Endert (1935) has indicated that he considers that Parijs' species should be reduced to synonymy with *H. myrtifolia* Miq. With this I do not agree, being of opinion that Parijs has actually described a species hitherto lacking a legitimate name.

Collections examined:—

- MALAY PENINSULA:
  - Perak: Forest Dept. F.M.S. 24609, 28806.
  - Selangor: Forest Dept. F.M.S. 21979, 47311, 47312, 47313; Ridl. 13206.
  - Pahang: Forest Dept. F.M.S. 4644, 37315, 38009.
  - Negri Sembilan: Forest Dept. F.M.S. 702, 1902, 2916, 4254, 4260, 6557, 18883, 18893, 23806, 26602, 43532.
  - Malacca: Maing. 1203 and 1394 (= K.D. 210; Herb. Lugd. Bat. 902146–375); Alvins 9; Goodenough 1444, 1554; Holmberg 820; Derry 124; Forest Dept. F.M.S. 2011, 2012, 9510, 18275, 25203, 25285.
  - Johore: Cantley 12; Forest Dept. F.M.S. 5208, 5846, 5858, 45943.
- RHIO ARCHIPELAGO:
  - Pulau Sugi: bb. 20386.
- SUMATRA:
  - Jambi: bb. 14459 (Holotype or Iso-holotype of *H. ferruginea* Parijs *ex* Herb. F.R.I. Buitenzorg).
  - Pelembang: bb. 187; H.B. 933.21.62; Field no. $8^{c}$, 193 (Herb. Lugd. Bat. 908353–258), Field No. $14^{c}$, 199 (Herb. Lugd. Bat. 908353–305).
- BORNEO:
  - South-West Residency: 1803 I (bb. 473; Utrecht 052390), 1803 II (bb. 474), 1871 (H.B. 938.10.87); bb. 13358, 20236, 20410.

*Hopea ferruginea* Parijs is here shown to be the correct botanical name for the form of *merawan* which appears to be the chief source of *damar mata kuching* in the Malay Peninsula. The tree is common in the Kuala Pilah district of Negri Sembilan where damar-tapping used to be carried on experimentally and commercially. The identity of the species has never been fixed with certainty, but it has usually been referred to *Hopea micrantha* or *Hopea intermedia* in publications of the F.M.S. Forest Department.



*Hopea Dyeri* Heim.

✓**Hopea Dyeri** Heim in Bull. Soc. Linn. Paris 2: 972 (1891); Brandis in Journ. Linn. Soc. (Bot.) 31: 68 (1895); Merr., Bib. Enum. Born. Pl. 402 (1921) quoad Becc. 2962; Sym. in Gard. Bull. S.S. 8: 53 (1934) et 9: 323 et 324 (1938) in notæ. *Hopea micrantha* sensu Burck in Ann. Jard. Bot. Buitenz. 6: 239 (1887) partim, quoad Becc. 2504*; sensu King in Journ. Asiat. Soc. Beng. 62: 124 (1893) partim, quoad King 3525; non Hopea micrantha Hook. f. *Hopea microptera* Dyer (Ms. in Herb. Kew) ex Brandis in l.c. pro synon. *Hancea microptera* (Dyer) Pierre, Fl. For. Cochinch. 4 (1891) in nota sub t. 248. *Hopea intermedia* King in l.c. 126 (1893) partim, quoad Kunstler 3709, et in Ann. Bot. Gard. Calcutta 5, pt. 2: 156 (1896) partim, quoad Kunstler 3709; Brandis in l.c. 67 partim, quoad Kunstler 3709; sensu Foxw., Mal. For. Rec. 10: 134 (1932) quoad Forest Dept. F.M.S. 5433. *Hopea Pierrei* sensu Brandis in l.c. 67 partim, quoad Becc. 2504 et 3050; sensu Ridl., Fl. Mal. Penins. 1: 238 (1922) partim; sensu Foxw., l.c. 133 quoad Kunstler 3525; non Hopea Pierrei Hance. **Plate 18.**

*Branchlets* slender, usually drying dark brown to black, lenticellate, glabrescent. Leaves ovate-lanceolate, caudate-acuminate at the apex, subequal and cuneate at the base, about 6.5 × 2.6 cm., glabrous on both surfaces, usually drying dark purple-brown and waxy-glaucescent on the upper surface, yellow-brown on the lower; midrib slightly raised on both surfaces; main nerves about 8 pairs, separated by hardly less prominent intermediate nerves, invisible on the upper surface, not elevate but clearly defined on the lower, usually furnished with small domatia in the axils of the lower pairs; petioles slender, about .7 cm. long, glabrescent; stipules minute, caducous. *Panicles* axillary or terminal, glabrous, of solitary or paired racemes which rarely exceed 2.0 cm. in length; ultimate branchlets about .6 cm. long, 3 to 5-flowered. *Flowers* about 1.0 mm. apart, secund, subtended by minute paired bracteoles which may be semi-persistent, about 3.0 mm. long and ovate-oblong in mature bud; pedicel about 1.0 mm. long, glabrous. *Sepals* glabrous; two outer subovate glandular-papillose towards the apex on both surfaces; three inner about the same height but broader and thinner. *Petals* linear-oblong, slightly fimbriate at the apex, sericeous on the portions exposed in bud, pale yellow. Stamens 15, arranged in the usual manner for this group, filaments broad at the base, narrowing about the middle to the filamentous upper portion;

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* Burck also cites Becc. 2964, possibly in error for 2962 which is the type of *H. Dyeri* Heim.

anthers oval, 4–celled, the anterior cells almost as large as the posterior; appendage to connective filiform, about as long as the filament and anther. *Ovary* and stylopodium of the "hour-glass" type; style short; stigma minute. *Fruit* glabrous; stalk about 1.0 mm. long, prominent; two outer calyx-lobes developed into wings about 4.0 × 0.7 cm., narrow towards the woody base, chartaceous, about 5-nerved; three inner lobes usually not enlarged beyond the lower half of the nut; nut ovate-conical, apiculate, shining, about .7 cm. long, embraced in the lower half by the calyx-lobes.

The earliest collections of this species were made by Beccari in Sarawak [numbers 2504 (fl.), 2962 (immature ft.) and 3050 (ft.)].

In 1887 Burck enumerated Becc. 2504* as *Hopea micrantha* Hook. f., but it is improbable that he actually compared the flowers of this collection with those of *H. micrantha* Hook. f., or he could not have failed to note the marked difference in stylopodium.

Dyer examined Becc. 2962 at Kew, giving it the manuscript name *Hopea microptera.* This name was never validly published, although it is mentioned in synonymy by later authors and is the basis of *Hancea microptera* Pierre.

Hance (1891) was the first to publish a name for the species when he based his *Hopea Dyeri* on Becc. 2962. In 1895, Brandis enumerated only this one collection under *H. Dyeri,* failing to identify Becc. 2504 and 3050 with it. Apparently misled by the similar stylopodium he placed these two collections under *Hopea Pierrei,* where there remained until I suggested their removal in 1938.

The earliest collections from the Malay Peninsula were made by Kunstler (3525 and 3709) in Perak in 1882–83. The former of these was referred by King to *Hopea micrantha,* and the latter was cited under *Hopea intermedia* by both King and Brandis. Ridley cited Kunstler's specimens under *H. Pierrei,* and Foxworthy cited no. 3525 under the same name.

Subsequent collections from the Peninsula are not numerous, and with the exception of 5433, cited by Foxworthy under *H. intermedia,* have been neglected in botanical publications.

This species is in leaf rather like *Hopea dryobalanoides* Miq. but it may be distinguished by the typical bottle-shaped ovary and stylopodium seen also in *H. Pierrei* Hance and *H. Beccariana* Burck.

Collections examined:—

MALAY PENINSULA:

PERAK: Kunstler 3525 (Herb. Lugd. Bat. 902146–376), 3709; Forest Department F.M.S. 14383.

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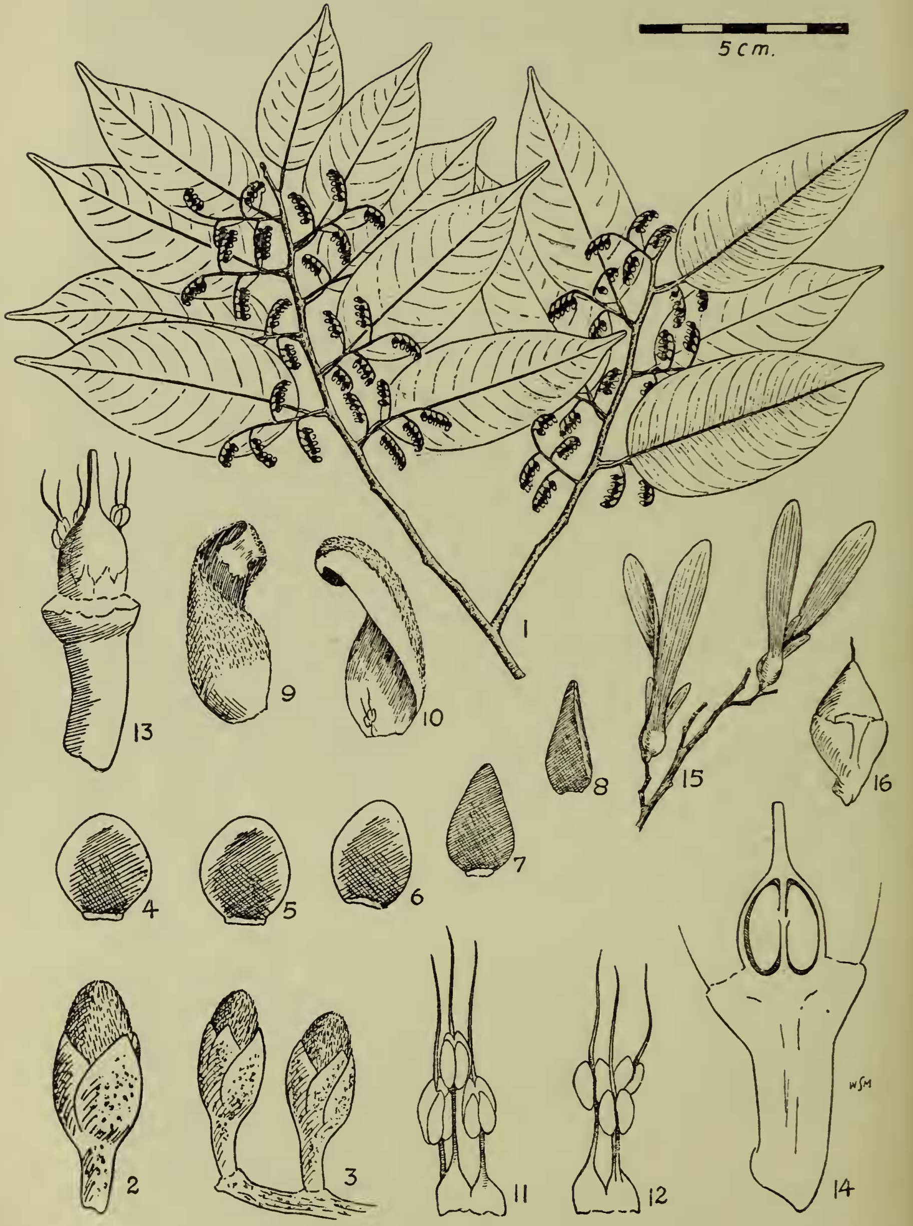
* *See* footnote on p. 353.



*Hopea micrantha* Hook.f.

TRENGGANU: S'pore Field No. 30142, 30184.
SELANGOR: Forest Dept. F.M.S. 18248, 48026.
NEGRI SEMBILAN: Forest Dept. F.M.S. 1906, 1907, 1923 to 1926, 48018.
PAHANG: Forest Dept. F.M.S. 4509, 5433.
BORNEO:
SARAWAK: Becc. 2504, 2962 (Iso-holotype of *Hopea Dyeri* Heim in Herb. Kew), 3050.

*Hopea Dyeri* Heim is a smooth-barked, stilt-rooted form of *merawan* of fairly wide distribution, but not very abundant, in the Peninsula. It is very similar in leaf and other characters to the species producing *damar mata kuching*, but does not itself produce globular or stalactitic exudations of damar. Early botanical collections of the species have been confused with others under a variety of names, the species never having been properly understood.

**Hopea micrantha** Hook. f. in Trans. Linn. Soc. 23: 161 (1862); Dyer in Hook. f., Fl. Brit. Ind. 1: 310 (1874) partim, quoad spec. Born.; Burck in Ann. Jard. Bot. Buitenz. 6: 239 (1887) partim, quoad Motley 215; Brandis in Journ. Linn. Soc. (Bot.) 31: 70 (1895) partim, quoad Motley 215; Merr., Bib. Enum. Born. Pl. 402 (1921) quoad Motley 215; Sym. in Gard. Bull. S.S. 9: 323–329 passim (1938); non H. micrantha sensu Hance in (Lond.) Journ. Bot. 15, 242 (1876); non sensu King in Journ. Asiat. Soc. Bengal 62, pt. 2: 124 (1893); non sensu Burkill in Journ. Str. Br. R. As. Soc. 81: 58 (1920) et Dict. Econ. Prod. Mal. Penins. 1190 (1935); non sensu Ridl., Fl. Mal. Penins. 1: 237 (1922); non sensu Foxw., Mal. For. Rec. 2: 167 (1932) in nota, et 10: 135 (1932). Non *Hopea micrantha* (Hassk.) Benth. et Hook. f. ex Heim, Rech. Dipteroc. 64 (1892) in obs. *Hancea micrantha* (Hook. f.) Pierre, Fl. For. Cochinch. 4 (1891) in nota sub t. 248. **Plate 19.**

*Branchlets* subterete, dark, minutely pale lepidote towards the ends. *Leaves* minutely lepidote, elliptic-ovate or ovate-lanceolate, caudate-acuminate at the apex, rounded at the base, usually about 7.0 × 3.0 cm., glabrous and drying yellowish-grey on the upper surface, glabrescent and dull yellow-brown on the lower; midrib slightly raised on both surfaces; main nerves about 13 pairs with 1 to 3 slightly less prominent intermediate nerves between each, faintly visible and slightly depressed on the upper surface, faint and hardly raised on the lower; petioles about 7.0 mm. long, subterete, lepidote. *Panicles* axillary towards the ends of the branchlets, or terminal; racemes solitary, less than 3.0 cm. long, sparsely furnished with minute waxy scales and hairs; ultimate branchlets about 1.0 cm. long, each with

4 to 6 secund flowered about 1.5 mm. apart. *Flowers* ovate-oblong in bud, about 4.0 mm. long including the pedicel; pedicel about 1.0 mm. long, drying black, sparsely minutely waxy-lepidote. *Sepals* drying black, sparsely, minutely waxy-lepidote outside; two outer ovate; three inner rotundate. *Petals* linear-oblong, tomentose on the portions exposed in bud. *Stamens* 15, in three rows of 5, arrayed as in most species of *Hopea;* filaments broad at the base, narrowing rather abruptly to a long filiform portion; anthers oval, 4-celled, the posterior cells larger than the anterior; appendage to connective filiform, about as long as the filament and anther. *Ovary* broadly cylindrical, narrowing to the style, glabrous; style erect, cylindrical, glabrous, about as long as the ovary; stigma minute. *Fruit** glabrous; pointed at the base; stalk very short; sepals woody at the base, chartaceous above; two large wings about 4.0 × 0.8 cm., blunt at the apex, very slightly constricted in the lower half, but slightly broader and tending to be auriculate at the base, about 7-nerved; three inner wings up to 1.5 cm. long but usually less; nut conical, about .8 cm. long, tapering gradually into the persistent style, coated with a resinous cement, closely appressed by and cemented to the imbricate bases of the sepals.

*Hopea micrantha* was originally described in 1862 from specimens (Nos. 215 and 100) collected by Motley in Labuan. Both specimens appear to have been considered in drawing up the description, but it is mainly based on no. 215 which bears flowers. No. 100 is sterile, and differs from 215 in the more ovate and inæquilateral, cuneate leaves. I do not think it is the same species and am therefore restricting Hooker's name to Motley 215. Motley 100 may be *Hopea sulcata* Sym. (*see* p. 359).

In 1874, Dyer recorded an extension of distribution of *H. micrantha* to the Malay Peninsula, citing "Malacca, Maingay". Presumably these are the sheets preserved under the *Hopea micrantha* cover at Kew with the Kew Distribution Number 210. Two separate collections are included under K.D. 210. (1) Field No. 1203, April 22nd 1867, and (2) Field No. 1394, May 25th 1867. In my opinion neither is *Hopea micrantha* Hook. f. Both sheets have flowers with ovaries and styles similar in shape to *H. micrantha* Hook. f., but the leaves and general *facies* is rather distinct. I consider them to be *H. ferruginea* Parijs (*vide* p. 351).

Dyer amplified Hooker's description with a brief description of the fruits. I do not know upon what collection his observations of fruits are based, but from the fact

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* The only known fruiting collection (Sarawak 00322) has slightly immature fruits.

that he says "bases of fruiting calyx-segments ¼ in. long with two gibbosities at the bottom", one might suspect a collection of *H. sulcata* Sym.

There have been many subsequent misinterpretations of the species. In 1876, Hance referred a Cambodian collection doubtfully to *H. micrantha,* but in the same year, realizing that it was distinct, he described it as a new species, *Hopea Pierrei.*

In 1897, Burck excluded the Malay Peninsula specimens referred to *H. micrantha* by Dyer, but included Beccari 2504 and 2964 from Borneo. Beccari 2504 is, in my opinion, *H. Dyeri* Heim. Becc. 2964 I have not seen, unless this number has been cited in error for 2962 which is the type of *H. Dyeri* Heim.

King, in 1893, retained the Malacca collections of Maingay under *H. micrantha* and added Kunstler 3525, which I considered to be *H. Dyeri* Heim, and three collections of Curtis (167, 266, 1397) and Kunstler 8170, which I consider to be *H. pedicellata* (Brandis) Sym. It is evident that King had mainly what we now call *H. pedicellata* in mind as *H. micrantha.*

Brandis removed some of King's citations under *H. micrantha,* but retained the Maingay collections from Malacca and added Cantley 12, which is also *H. ferruginea* Parijs.

Ridley's *H. micrantha* is mainly a mixture of *H. ferruginea* Parijs and *H. pedicellata* (Brandis) Sym., while Foxworthy's includes specimens of *H. sulcata* Sym., *H. dryobalanoides* Miq., *H. ferruginea* Parijs, and *H. sangal* Korth.

Numerous collections of *Hopea,* now preserved in the herbaria at Utrecht, Leiden, and Buitenzorg, have been wrongly identified as *H. micrantha* by other Dutch botanists, but I cannot find any attempt by them to elucidate the identity of *H. micrantha* in published works.

The confusion which exists is, of course, due to the very close similarity of many species in the *Dryobalanoides* section of *Hopea.* Of all the specimens cited from time to time under the name of *H. micrantha,* I consider that Motley 215 from Labuan (the original specimen) is the only one correctly placed in that species. I have only seen three other collections, which I feel can be referred to Hooker's species in the strict sense. I would have preferred to have awaited additional collections from the type locality before venturing even to say that these are identical with Motley 215, but as examination of the only remaining patch of jungle on the Island of Labuan failed to reveal any *Hopea,* the prospect of ever obtaining such collections is negligible.

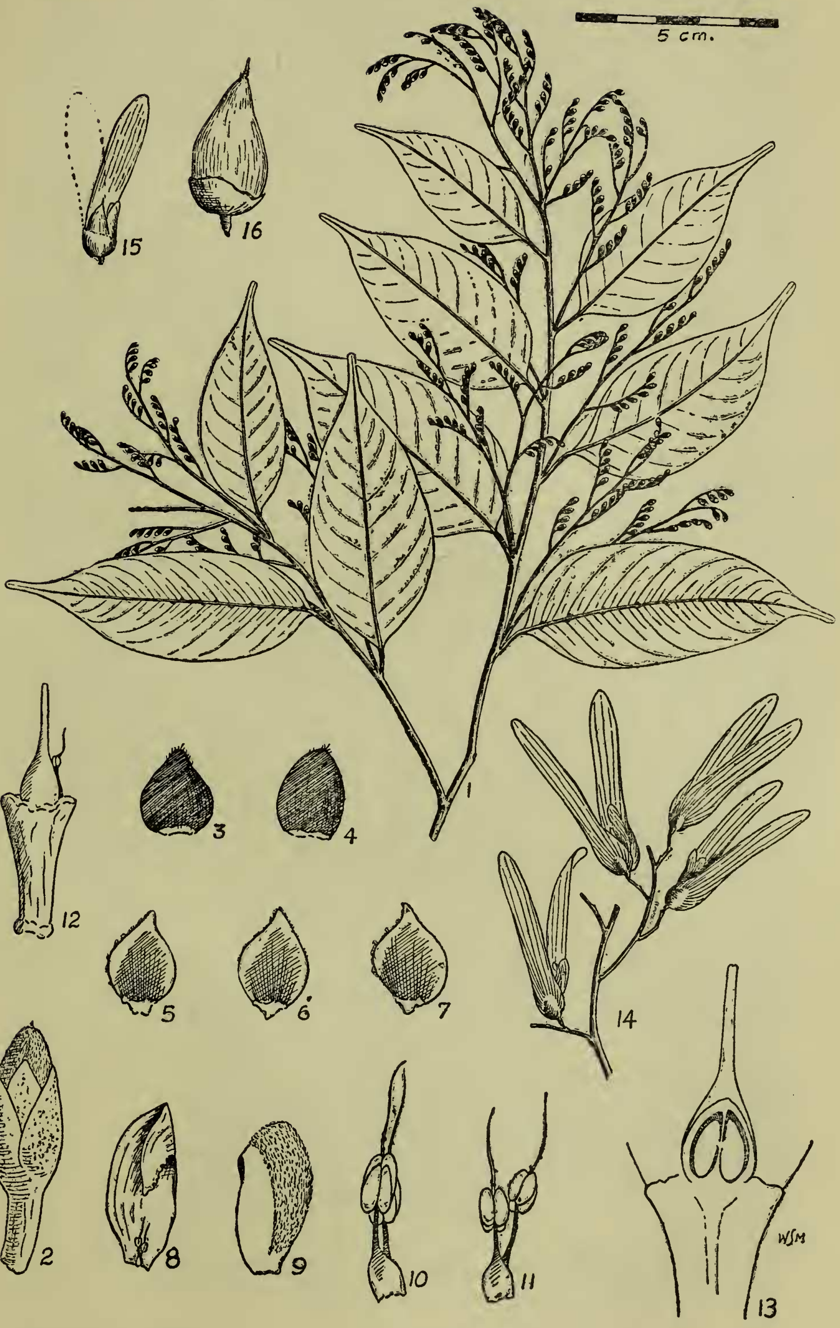
Collections examined:—
BORNEO:
LABUAN: Motley 215 (Lectotype, *sec.* Sym., of *H. micrantha* Hook. f. in Herb. Kew).
BILITON: ? Biliton Herb. No. 91 (Herb. Lugd. Bat. No. 90923–676).
BRUNEI: Forest Dept. F.M.S. 30551.
SARAWAK: Egon 00322 (Sarawak 356)

*Hopea micrantha* is a form of *merawan* described originally from Labuan. Many other species, mainly from Borneo and the Malay Peninsula, have from time to time been referred to *H. micrantha* in error. Among these is the tree known as *merawan meranti* in Selangor, which is described in this paper as *Hopea sulcata.* An attempt is here made to describe the true *H. micrantha* more fully, and the opinion is expressed that it does not occur in the Malay Peninsula.

√ **Hopea sulcata** Symington, **sp. nov.** *H. micrantha* sensu Foxw., Mal. For. Rec. 10: 135 (1932) partim; non H. micrantha Hook. f. sensu stricto. **Plate 20.**

*H. micranthae* Hook. f. (sensu stricto) valde affinis sed foliis basi cuneatis, paniculis laxioribus distincta.

*Branchlets* pale, minutely waxy lepidote and sparsely stellate-hairy towards the ends, decurrent leaf traces rather prominent. *Leaves* ovate- to elliptic-lanceolate, caudate-acuminate at the apex (acumen up to 1.5 cm. long, blunt), slightly unequal and usually cuneate at the base, usually about 7.0 × 4.0 cm. but considerably variable, minutely waxy lepidote, glabrous but for a few tufted domatia on the lower surface, usually drying a dull grey-green on the upper surface, yellow-brown on the lower; midrib slightly raised on both surfaces; main nerves about 10 pairs, almost invisible on the upper surface, distinct on the lower and frequently with small pore-like or tufted domatia in their axils; intermediate nerves hardly less prominent than the main nerves; reticulations invisible to the naked eye; petioles about .7 cm. long, subterete, dark or waxy-lepidote; stipules minute, caducous. *Panicles* axillary or terminal, of solitary or paired racemes, rather lax, up to 7.0 cm. long, puberulous; rachis slightly flattened; branchlets 10.0 to 17.0 mm. long, each bearing about 4 to 7 secund flowers about 1.5 mm. apart. *Flowers* ovate-oblong in bud, about 4.5 mm. long including the pedicel; pedicel 1.5 mm. long, glabrescent, drying black. *Sepals* subovate, waxy outside, sparsely ciliate along the apical margins; two outer obtuse; three inner usually shortly acuminate. *Petals* oblong, fimbriate at the apex, tomentose on the portion exposed in bud. *Stamens* 15 arranged in the usual manner in this group; filaments broad at the base, filiform in the upper half;



*Hopea sulcata* Sym.

anthers oblong, 4-celled, the anterior cells slightly smaller than the posterior; appendage to connective filiform, twice as long as the anther, sparsely papillose towards the base. *Ovary* ovate-conical, glabrous, tapering into an erect, cylindrical, glabrous style which is slightly longer than the ovary; stigma minute. *Fruit* glabrous; stalk about 1.5 mm. long, attached to the slight concavity formed by the enlarged sepal bases; sepals chartaceous except for the thickened, woody bases, blunt at the apex; two outer sepals about 6.0 × 1.0 cm. or slightly less, linear-oblong, auriculate at the base and slightly constricted above the auricles, about 7-nerved; three inner sepals short, usually less than 1.0 cm. long, subequal or with one considerably larger than the other two; nut ovate-conical, frequently slightly oblique, about 1.2 × 0.7 cm., glabrous, shining, minutely apiculate or crowned by the awn-like remnant of the style, closely embraced in the lower half by the imbricate sepal bases.

This species, although collected by members of the forest department and communicated to the Singapore Botanic Gardens as early as 1916, does not appear to have been considered in the *Flora of the Malay Peninsula*. The first specimens to be cited in botanical literature are referred by Foxworthy to *Hopea micrantha*.

*Hopea micrantha* Hook. f. was originally described from two specimens, Motley 215 (flower) and Motley 100 (sterile). As I have stated on p. 356, I consider that these differ, and am restricting the name *H. micrantha* to the flowering specimen. It is probable that the species under discussion is conspecific with Motley 100, but I am satisfied that it is distinct from Motley 215 and cannot be referred to *H. micrantha sensu stricto*. The most obvious differences are the laxer inflorescence, more prominently auriculate fruits, and cuneate leaf bases of *H. sulcata*.

Collections examined:—

MALAY PENINSULA:

PERAK: Forest Dept. F.M.S. 16203, 30347 to 30350 inclusive, 39172, 39197, 40614, 45151, 45152, 45217.

SELANGOR: Forest Dept. F.M.S. 730 (Type of *H. sulcata* Sym.); leg. ?; Sungei Lalang Forest Reserve, Kajang, Selangor; 10th June, 1916; flower.

Also—Yeop *s.n.* (tree No. 113; 5th June, 1917); Forest Dept. F.M.S. 7907, 1043, 13022, 22068, 22856, 24058, 26251, 26258, 26259, 26260 to 26265 inclusive, 26272 to 26278 inclusive, 26285, 26288, 26291 to 26294 inclusive, 26355, 26356, 26358, 26360 to 26365 inclusive, 26389, 26390 to 26393 inclusive, 26480, 26482 to 26486 inclusive, 45062, 45834, 47109.

JOHORE: S'pore Field No. 30988.

BORNEO:

LABUAN: ? Motley 100 (Syntype of *H. micrantha* Hook. f. in Herb. Kew).

*Hopea sulcata* is the name here given to a form of *merawan* with deeply fissured bark. It has for long been known to be abundant in the south of Sungei Lalang Forest Reserve in Selangor where it is known as *merawan meranti*. Formerly the species was thought to be identical with a Bornean species called *Hopea micrantha*.

√**Hopea latifolia** Symington, **sp. nov.** *H. intermedia* sensu Foxw., Mal. For. Rec. 10: 134 (1932) partim; non H. intermedia King. *H. Beccariana* sensu Sym. in Gard. Bull. S.S. 93: 325 (1936) partim; non H. Beccariana Burck.

*H. Beccarianae* Burck habitu similis, sed foliis latioribus, basi saepissime rotundatis, acumine (breviore, fructus stylis persistentibus gracilioribus distincta. Flores ignoti.

*Branchlets* glabrous, drying with a silvery tinge. *Leaves* broadly elliptical, shortly blunt-acuminate at the apex, rounded or sometimes cuneate at the base, frequently slightly reflexed along the margins, about 5.0 × 2.75 cm. to 8.0 × 4.5 cm., entirely glabrous, drying light yellow-brown or greenish-yellow on both surfaces; midrib elevate on both surfaces; main nerves about 8 to 10 pairs, separated by slightly shorter and hardly less prominent intermediate nerves, slightly depressed and almost invisible on the upper surface, faint and not raised on the lower; petioles slender, about 1.5 cm. long, glabrous. *Panicles* terminal or axillary towards the ends of the branchlets, glabrous, of solitary or paired racemes not exceeding 3.0 cm. in length; branchlets up to 9.0 mm. long, 2 to 5-flowered. *Flowers* unknown. *Fruits* glabrous; stalk short and stout, about 1.5 mm. long; two outer calyx-lobes developed into wings, about 4.0 × 0.9 cm., narrow towards the woody base, about 7-nerved; three inner lobes broad, not enlarged beyond the lower half of the ripe nut; nut ovate, pointed, about 1.0 cm. long, surmounted by the thin, frequently reflexed, remnant of the style (sometimes broken off), embraced by and sometimes cemented to the sepals on the lower half.

This species is rather rare and collections are few, fruiting material only being known. The leaves very closely resemble those of the species which Foxworthy called *H. intermedia* and I consider to be *H. Beccariana* Burck, and we have both erroneously cited collections of *H. latifolia* under these names. The specimens Forest Dept. F.M.S. 8149, 41552, 5852, and 5863 should be removed from my list of collections examined on page 327 of *Gard. Bull. S.S.* 9 (1938), and enumerated here.

I have compared this species to *H. Beccariana* because in leaf venation and length of petiole they are very alike. When flowers are available, however, it is probable that

*H. latifolia* will be found to have a stylopodium of the *Hopea micrantha* type, *i.e.* with a long slender style, and not one of the *H. Beccariana*, "hour-glass", type. The stylar remnant on the fruits of *H. latifolia* is typical of that which develops from flowers with a slender style.

Collections examined:—

MALAY PENINSULA:

PAHANG: Forest Dept. F.M.S. 8149 (Type of *Hopea latifolia* Sym.); Forest Guard Mahamud; Telok Siseh, Kuantan, flat land; 15th January, 1928; fruit. Field notes—"vern. name, *merawan batu;* tree 60 ft high, 4 ft girth; fruits green". Also—Forest Dept. F.M.S. 49838.

MALACCA: Forest Dept. F.M.S. 41552.

JOHORE: Forest Dept. F.M.S. 5852, 5863.

*Hopea latifolia* Sym. is a *merawan* of the smooth-barked type which has been recorded from Kuantan in Pahang, Malacca, and Johore. In leaf it is very like *H. Beccariana* (merawan batu) with which it has been confused. The species is here described for the first time.

**Hopea mengarawan** Miq., Fl. Ind. Bat. Suppl. 492 (1860); Scheffer in Nat. Tijdscr. Ned. Ind.: 351 (1870); Burck in Ann. Jard. Bot. Buitenz. 6: 240 (1887) pro majore parte, excl. var. cernua; King in Journ. Asiat. Soc. Bengal 62, pt. 2: 125 (1893) in obs. sub H. micrantha; Brandis in Journ. Linn. Soc. (Bot.) 81: 70 (1895) pro majore parte; Ridl., Fl. Mal. Penins. 1: 238 (1922); Foxw., Mal. For. Rec. 10: 137 (1932).

*Hopea mengarawan,* although described by Miquel in 1860 from sterile material, has been subject to less confusion than any of the other early collections of the *Dryobalanoides* group of *Hopea*. The sterile type collection from Palembang is cited as "*Sumatra orient prope Muara-duwa* (Teysmann)". Among the Buitenzorg, Leiden, and Utrecht sheets of *Hopea,* which presumably contain the type specimen, there is none with this annotation, but there is a collection of Teysmann's from "Muara-enim" which bears the name *Hopea mengarawan* in Miquel's handwriting.

In 1870 Scheffer added two collections from Bangka, and one from the river Tarabangi in Lampong Province. From the last he drew a brief floral description, but erroneously stated that the stamens are 10 in number.

In 1887 Burck added another collection by Teysmann, and transferred to *H. mengarawan* a collection from Sungei Pagu which Miquel had included in his *H. dryobalanoides*. I think this was unjustified (*see* my notes under *H. dryobalanoides*, p. 346). From Borneo, Burck cited Becc. 2545 which is, in my opinion, *H. cernua* Teysm. et Binn., a species considered by Burck to be only a variety of *Hopea mengarawan*. In this he has not been supported by Brandis or any subsequent author: I consider the two species quite distinct, although they have a similar ovary and style.

Brandis added the first Malay Peninsula collections, made by Cantley in Johore and Ridley in Singapore. But he wrongly included under *H. mengarawan,* King 8170, which is *H. pedicellata* (Brandis) Sym. and Goodenough 1447, which I consider to be *H. Beccariana* Burck. He cited another Sumatran collection, Forbes 3210, which has remarkably large flowers but closely resembles *H. mengarawan* in floral structure and leaf texture, and is probably correctly referable to it.

Ridley and Foxworthy later added more collections from the Malay Peninsula, all of which I have seen and agree are referable to this species. The Malay Peninsula specimens vary somewhat among themselves and differ from the Dutch collections in having broader, or more leathery leaves, but they are identical in flower structure, having the broad hairy ring at the base of the long style which may be seen in Teysmann's Lampong collection.

Collections examined:—

SUMATRA:

- Palembang: Teysmann *s.n.*, "Muara-enim" (H.B. 4022 and 938.12.10; Utrecht 035930) (? Holotype of *Hopea mengarawan* Miq.); *s.n., leg.?* (Herb. Lugd. Bat. 908353–255 and 299).
- Lampong: Teysmann, "*ad fl.* Tarabangi" (H.B. 938.12.12; Utrecht 035929).
- Locality uncertain: Korthals *s.n.* (Herb. Lugd. Bat. 902146–348); Teysmann *s.n.* (Herb. Lugd. Bat. 902146–341; perhaps a duplicate of H.B. 938.12.10); Forbes 3210*a* (Herb. Lugd. Bat. 908140–1910 and 908146–226).

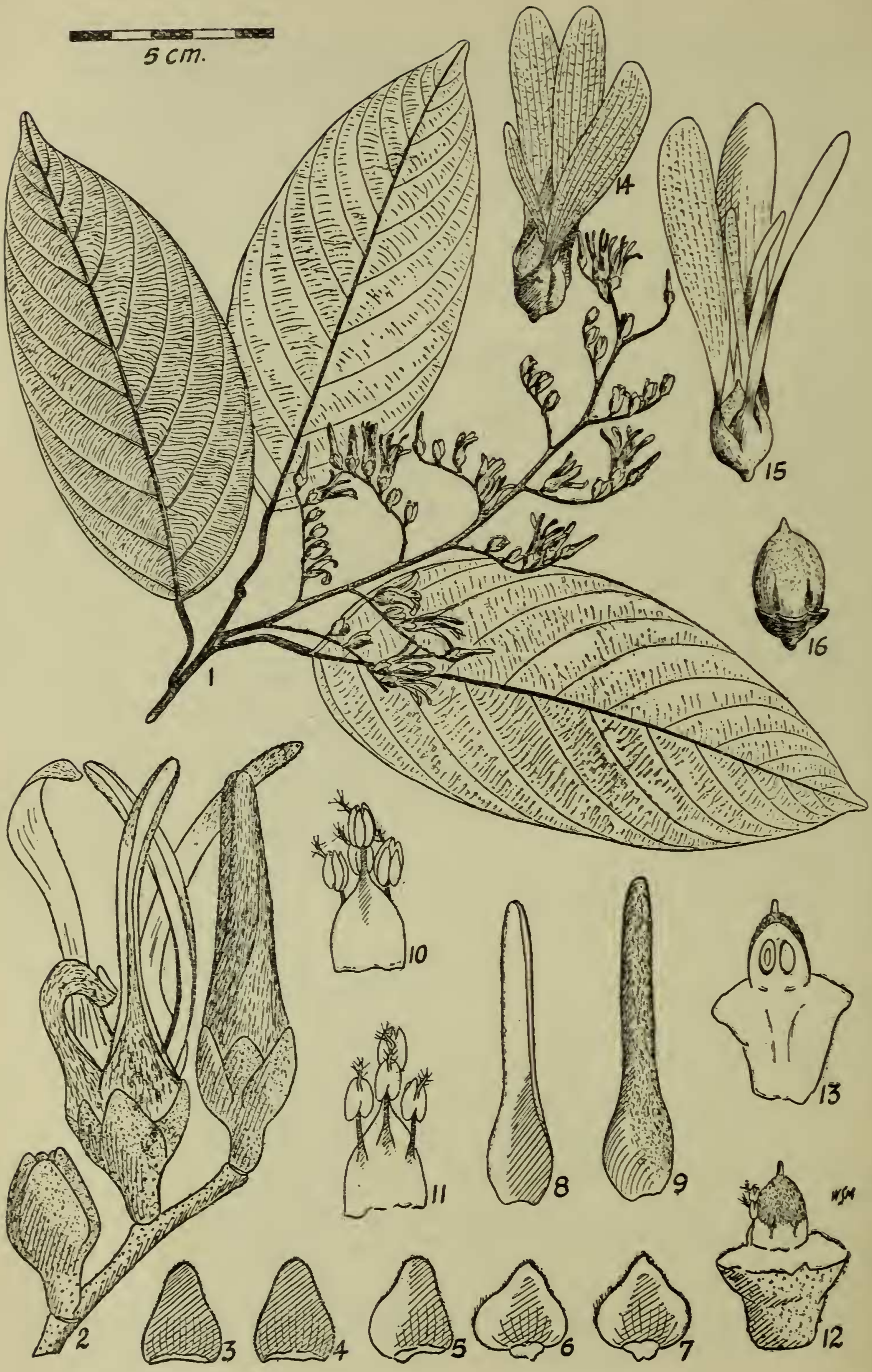
BANGKA: Teysmann *s.n.*, "prope Djeboes" (H.B. 3225 and 938.12.9); Teysmann *s.n.*, "Belienjoe" (H.B. 938.12.13); *s.n., leg.?*, (Herb. Lugd. Bat. 908154–37 det. *Tristania obovata*).

BILITON: Teysmann *s.n.* (H.B. 11059 and 938.12.11); van Rossum 61 (Utrecht 029954).

MALAY PENINSULA:

- Pahang: Forest Dept. F.M.S. 0721, 0734, 0735, 2638, 4621, 5481, 5742, 6540, 7941, 10015, 10554, 10572, 15636, 17145, 17238, 17245, 17249, 17261, 29556, 29608, 29978, 31679, 36039, 37324, 38010, 40675.
- Selangor: (Cult.) Forest Dept. F.M.S. 14835.
- Negri Sembilan: Forest Dept. F.M.S. 1883, 43518.
- Malacca: Forest Dept. F.M.S. 45902.
- Johore: Cantley 205; S'pore Field No. 26139; Forest Dept. F.M.S. 6021.
- Singapore: Ridl. 5094, 5843, 10733, *s.n.* (Bukit Timah), *s.n.* (Grange Road); Gardens No. 2002 (H.B. 938.10.49 and 50).

*Hopea mengarawan* is a well-known form of *merawan* in lowlying parts of Pahang and Johore. Investigation shows that our conception of the species is correct.



*Shorea atrinervosa* Sym.

**Shorea atrinervosa** Symington, **sp. nov.** V. Sl. ex Merr., Plant. Elmer. Born. 203 (1929) in nota sub S. malibato Foxw. *Shorea collina* sensu Foxw., Mal. For. Rec. 10: 173 (1932) partim; non S. collina Ridl. *"Shorea ? inappendiculata"* Sym. ex Desch, Mal. For. Rec. 12: 9 (1936) partim; et Govt. Gazette F.M.S. Vol. 29, No. 26, Not. no. 5994, (List of Botanical and Vernacular Equivalents), p. 2 (1937) partim. **Plate 21.**

*S. ciliatae* King et *S. astylosae* Foxw. valde affinis sed omnibus partibus majoribus satis distincta.

*Branchlets* sparsely hairy at the ends, becoming dark, glabrous, and lenticellate. *Leaves* elliptic or ovate-oblong, shortly blunt-acuminate at the apex, rounded to slightly cuneate and sometimes slightly unequal at the base, about 8.0 × 4.0 cm. to 15.0 × 7.3 cm., glabrous and usually drying a dull purple-brown on the upper surface, glabrous and frequently more or less minutely pale (sometimes coppery) lepidote beneath; midrib prominent, usually drying black, slightly elevate on the upper surface, more prominently elevate beneath; main nerves 10 to 14 pairs, inconspicuous on the upper surface, prominent beneath, frequently drying black, and sometimes with small pore-like domatia in their axils on the lower surface; tertiary nerves scalariform, fine but usually visible to the naked eye on both surfaces; petioles 2.0–2.8 cm. long, glabrescent, drying black; stipules caducous (not seen), scars rather prominent. *Panicles* terminal or axillary towards the ends of the branchlets; racemes solitary, up to 14.0 cm. long, hoary stellate-hairy; branchlets regularly alternating, distichous, about 1.0 cm. apart, rather lax, up to 3.5 cm. long, hoary stellate-hairy or tomentose, 3 to 10–flowered (usually about 7). *Flowers* secund, about 3.0 mm. apart, about 15.0 mm. long in mature bud; pedicels short, stellate-tomentose. *Sepals* densely pale tomentose; three outer ovate, obtuse; two inner broadly ovate, acute. *Petals* linear, broad at the base, adpressed sericeous outside and minutely pubescent towards the apex inside, bright red at the base, pale yellow to white towards the apex (Symington). *Stamens* 25 to 31 (in flowers examined), of several heights, the innermost row being the tallest; filaments 1 to 3 times as long as the anthers, broad and flattened at the base, filamentous in the upper portion; anthers elliptical, 4-celled, the posterior cells considerably shorter than the anterior; appendage to connective rather thick, blunt, about half as long as the anther, furnished with 5 to 12 long spreading ciliæ. *Ovary* and stylopodium ovoid-conical, densely sericeous-tomentose except at the base; style short, cylindrical, glabrous, stigma minute. *Fruit:* stalk short, stout, stellate-hairy; bases of calyx-lobes woody, sparsely hairy at the foot, closely embracing the lower half of the nut; wings glabrescent or minutely puberulous; the three outer about 8.0 × 1.4 cm., slightly narrowed towards the base, about 9-nerved; the two inner subequal, linear, 2–4 cm. long, about 4-nerved; nut ovate-orbicular; pointed, about 2.0 cm. × 1.5 cm., pale sericeous-tomentose.

This species is a typical *Eushorea*, being very similar, both in leaf texture and in flower structure, to *Shorea ciliata* King and *Shorea astylosa* Foxw., but differing in the greater size of all parts.

The earliest collections from the Malay Peninsula, Forest Dept. F.M.S. 3565 and 3566, were made in 1923. These were included in Foxworthy's conception of *S. collina*. In 1936 I confused this species with one very similar in leaf described in this paper as *Shorea lumutensis*, and enumerated them in l.c. under "*Shorea* ? *inappendiculata*".

Collections examined:—

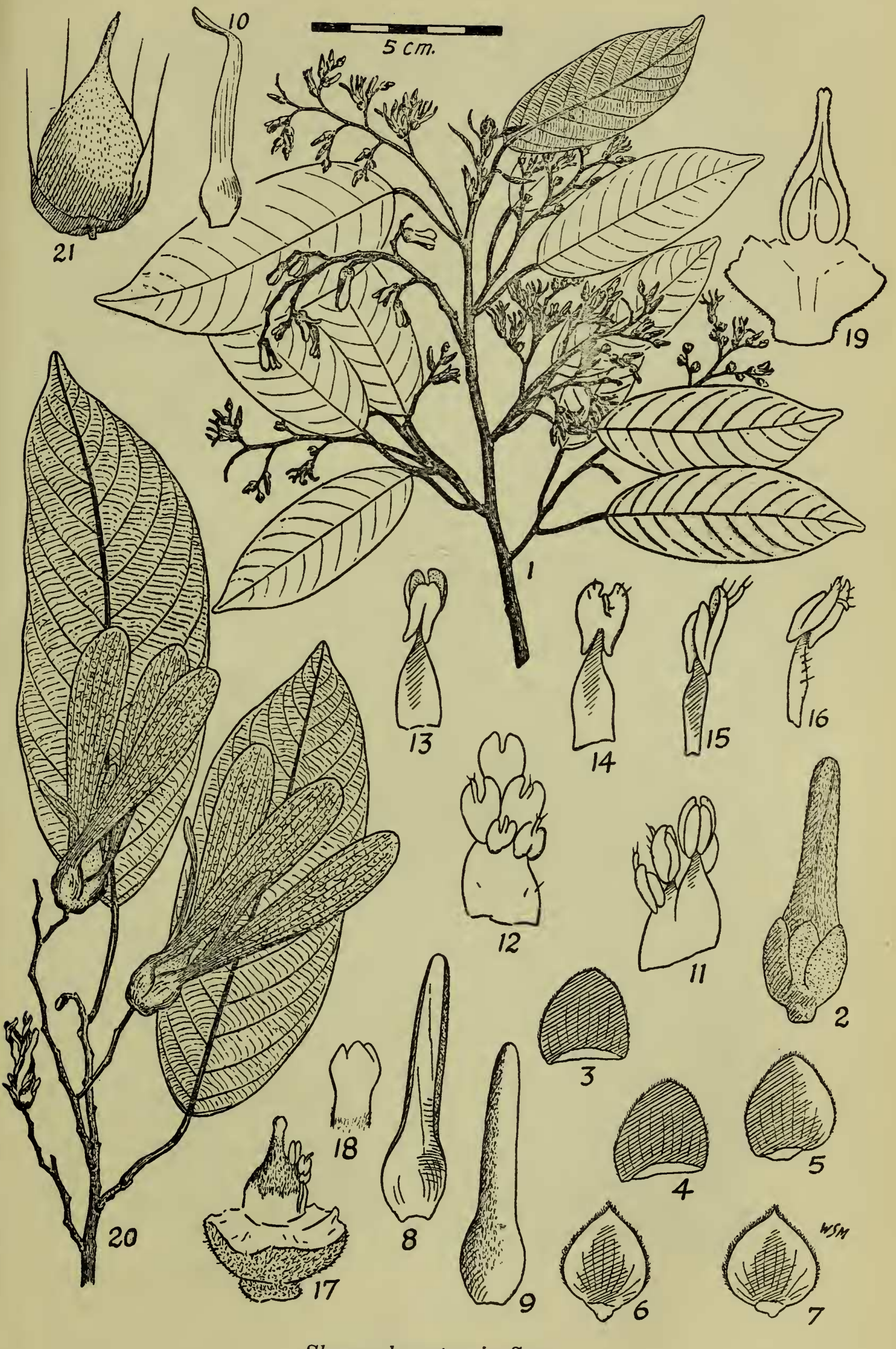
MALAY PENINSULA:
- TRENGGANU: Forest Dept. F.M.S. 26951, 43020.
- PAHANG: Forest Dept. F.M.S. 31832 (Type of *Shorea atrinervosa* Sym.); Alwi; Bukit Goh Forest Reserve, Compt. 10; 24th Oct., 1938; flowers. Field notes—vern. name, *balau hitam;* tree 100 ft high, 7 ft 8 in. girth; flower white.
  Also—Forest Dept. F.M.S. 3565, 3566, 6829, 17220, 17364, 17365, 17366, 17367, 43129, 49846, 49860, 49862.

SUMATRA:
- ACHIN: bb. 2926, 8871.
- WEST COAST: bb. 3762, 5484, 6118, 7040, 7693, 14955, 15465, 15466, 18360, 18600, 18602, 18623, 18711, 18720, 18729, 19320, 19333, 19348, 19389, 19474, 19498, 19501, 19502, 19504, 19623, 19661, 19662, 20306.
- EAST COAST: bb. 8647.

BORNEO:
- SARAWAK: Forest Dept. Sarawak A. 0587.
- BRUNEI: Forest Dept. F.M.S. 28711 (?).
- NORTH BORNEO: Elmer 21414.
- SOUTH and EAST BORNEO: bb. 11683.

*Shorea atrinervosa* is the name here given to the hitherto unnamed tree called *balau hitam,* which occurs in eastern Trengganu and Pahang. In *Mal. For. Rec.* 12, and in our *List of Botanical and Vernacular Equivalents* this species was confused with *S. lumutensis,* both appearing under the heading "*Shorea* ? *inappendiculata*". The species appears to be common on the West Coast of Sumatra where it is frequently called *resak* or some variant of that name.

**Shorea lumutensis** Symington, **sp. nov.** "*Shorea ? inappendiculata,* Sym. ex Desch, Mal. For. Rec. 12: 9 (1936) partim, et Govt. Gazette F.M.S. Vol. XXIX, No. 26, Not. no. 5884 (List of Botanical and Vernacular Equivalents), p. 2 (1937) partim. **Plate 22.**



*Shorea lumutensis* Sym.

*S. inappendiculatae* Burck valde affinis sed stylis sericeo-tomentosis, petiolis longioribus differt.

*Branchlets* deciduous stellate-hairy at the ends, later becoming glabrous and dark. *Leaves* oblong or elliptic-oblong, acuminate at the apex, acute or truncate at the base, margins slightly sinuate, very variable in size from about 7.0 × 2.5 cm. to 29.0 × 7.0 cm., glabrous and drying a dull pale purple-brown colour (sometimes sparsely minutely scurfeous) on the upper surface, minutely grey-green scurfy-lepidote (except on the veins) on the lower surface; midrib neither conspicuously sunk nor elevate on the upper surface, prominently elevate, glabrescent, drying dark in colour, on the lower; main nerves 12 to 16 pairs, faint above, prominent and frequently drying black on the lower surface; tertiary nerves scalariform, faintly visible on the upper surface, more prominent beneath; petioles rather slender, about 2.8 in. long on an average-sized leaf, usually scurfy-lepidote on the posterior surface, glabrous and drying dark on the anterior; stipules caducous. *Panicles* terminal or axillary towards the branch ends; racemes solitary, up to 10.0 cm. long but usually less, hoary tomentose; branchlets usually about 1.0 cm. long and about 5-flowered. *Flowers* subsecund, about 9.0 mm. long in mature bud, almost sessile. *Sepals* densely pale tomentose outside; three outer ovoid-deltoid, obtuse; two inner ovoid, acute or shortly acuminate. Petals linear, broad at the base, sericeous-tomentose outside and minutely tomentose towards the apex on the inner surface, pale yellow (C.L. Carrier). *Stamens* 20 to 24 (in flowers examined), of several heights, the innermost row being the tallest; filaments rather short, the tallest not more than twice as long as the anthers, broad at the base, narrowing at the top, sometimes furnished with a few short bristles on the anterior surface; anthers elliptic-obovate, 4-celled, posterior cells smaller than the anterior, shoulders of anterior cells usually furnished with a few short bristles; appendage to connective a short blunt process usually furnished with 1 to 2 bristles (on the anterior stamens the process is erect and slightly exceeds the shoulders of the anther cells; on the posterior stamens the process is rudimentary, or at any rate much shorter, and becomes markedly reflexed as the flower matures). *Ovary* and stylopodium ovoid-conical, sericeous-tomentose except at the base, tapering gradually into the short, thick, tomentose style; stigma slightly enlarged and obscurely 3-lobed. *Fruit* sessile; bases of calyx-lobes woody, stellate-hairy, enveloping the lower third of the nut; wings puberulous; the three outer about 7.0 × 1.5 cm., narrow towards the base, about 9-nerved; the two inner sublinear, up to 4.0 cm. long, about 5-nerved; nut subovate, tapering to a long curved beak, pale sericeous-tomentose, up to 2.0 cm. long including the beak.

This species was first detected in the field in 1931, but neither flowers nor fruits were collected until 1938–39. The close resemblances in leaf characters between this and *Shorea inappendiculata* Burck prompted me to give it the temporary name of "*Shorea* ? *inappendiculata*". Now that fertile specimens have been procured it appears that the species is indeed very closely related to *S. inappendiculata* Burck. The only essential, readily definable difference is that the style of *S. lumutensis* is hairy, whereas that of *S. inappendiculata* is glabrous.*

Collections examined:—

MALAY PENINSULA:

DINDINGS (LUMUT): Forest Dept. F.M.S. 34800 (Type of *Shorea lumutensis* Sym.); C.L. Carrier; Compt. 7, Lumut Forest Reserve; 29th Dec., 1938; flowers. Field notes—"vern. name, *balau;* tree about 70 ft to first branch, 72 in. girth; flower pale yellow; immature fruit pale green".

Also—Forest Dept. F.M.S. 16808, 16809, 16840 to 16846 inclusive, 27762, 27766, 27772, 34796, 34797, 34803, 47338.

*Shorea lumutensis* is the name here given to a form of hard-wooded *Shorea* occurring on the coastal hills of the Dindings. In 1931, when it was first discovered, no local vernacular name could be found for it but the name *balau bukit* seems to have come into use of recent years. As, however, this name is the "preferred" name for *S. Foxworthyi,* it is suggested that we encourage the name *balau puteh* for *S. lumutensis.* In *Mal. For. Rec.* 12 this species was referred to as "*Shorea* ? *inappendiculata* because of its possible identity with a Bornean species, *Shorea inappendiculata* Burck.

**Shorea Meadiana** Symington, **sp. nov.** "*Shorea sp. nov.*" Sym. ex Desch, *Mal. For. Rec.* 12: 9 (1936). **Plate 23.**

Inter species peninsulares Sectionis *Eushoreae* probabiliter *S. sumatranae* (V. Sl. ex Foxw.) Sym. maxime affinis, sed foliis minoribus, cetis appendicum paucioribus, fructu longe-alato valde distincta.

*Branchlets* slender, terete, minutely stellate-hairy to softly tomentose towards the ends, drying dull grey- or

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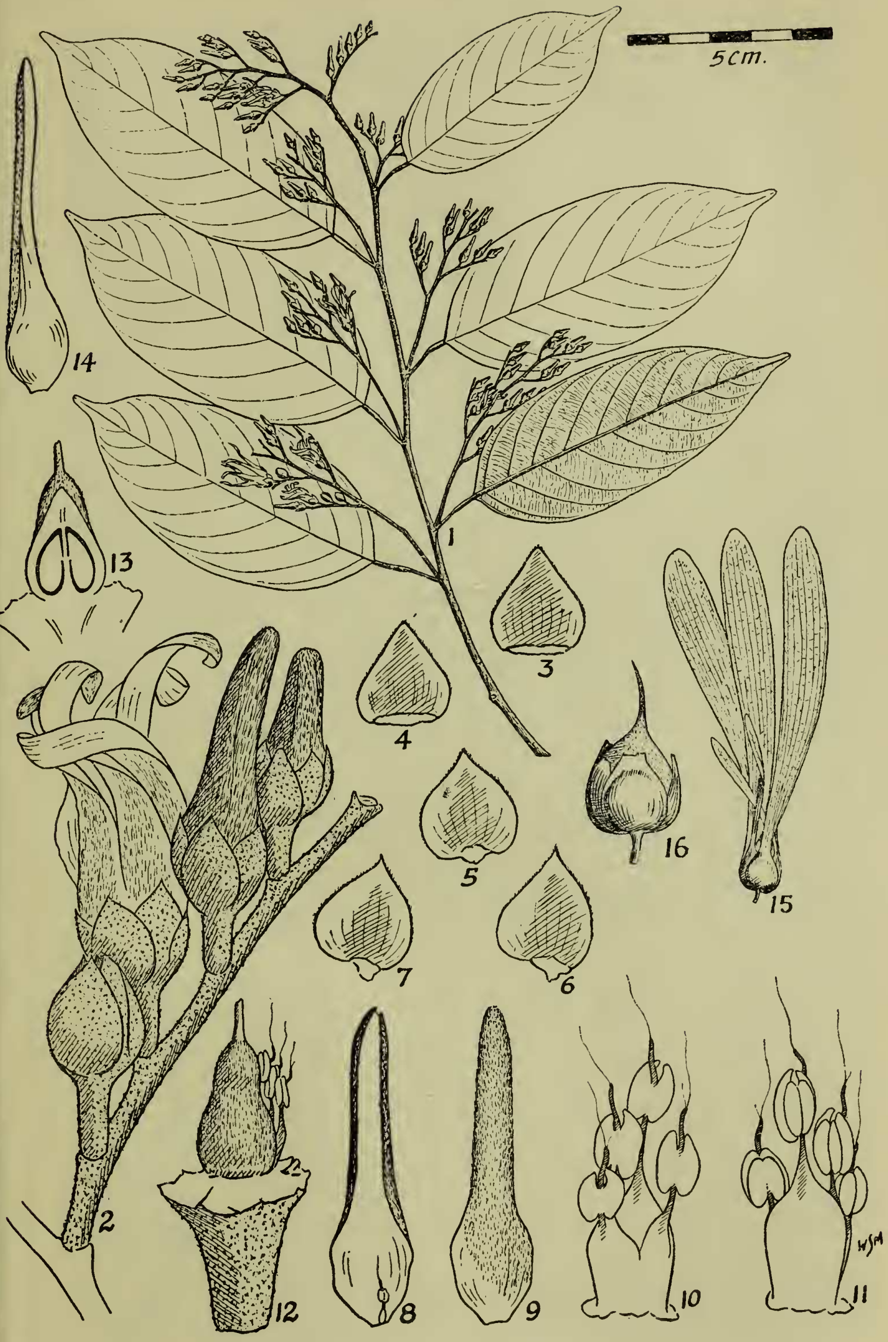
* The name *Shorea inappendiculata* as well as the descriptions of Burck, and particularly Brandis, are misleading. The appendages to the connectives are actually larger than in *S. lumutensis,* while the bristles on the connectives and anther cells, although more numerous than in *S. lumutensis,* are not at all as figure by Brandis.



*Shorea Meadiana* Sym.

reddish-brown to black. *Leaves* ovate-, elliptic-, or oblong-lanceolate, shortly acuminate at the apex, acute or rounded and sometimes slightly unequal at the base, averaging about 8.0 ×3.4 cm. from mature trees but much larger from immature ones, thin and chartaceous in texture, glabrous and usually drying dull red-brown on the upper surface, sparsely minutely hairy on the nerves and usually drying dull greenish- or yellow-brown on the lower surface; midrib slightly sunk on the upper surface, rather prominent, striated, and sparsely stellate hairy on the lower surface; main nerves usually 9 pairs, almost invisible on the upper surface, fine but prominent and sparsely stellate-hairy beneath; tertiary nerves joining the main nerves in fine, close, parallel, curved lines, invisible above, faintly visible to the naked eye on the lower surface; petioles 1.0–1.5 cm. long, slender, slightly thickened in the upper half, minutely stellate-hairy or tomentose; stipules caducous, not seen. *Panicles* terminal or axillary towards the ends of the branchlets; racemes solitary, about half as long to as long as the leaves, minutely stellate-hairy; ultimate branchlets regularly alternating, about 5.0 mm. apart, 2 to 6-flowered. *Flowers* about 2.0 mm. apart, secund, about 10.0 mm. long in mature bud; pedicel 2.0 mm. long, tomentose. *Sepals* broadly ovate, subequal in size, tomentose outside; the three outer usually blunt; the two inner shortly, sharply acuminate at the apex. *Petals* linear, broad at the base, curved inwards along the margins when over-mature, tomentose outside, greenish-yellow (Symington). *Stamens* 28 to 32 (in flowers examined); filaments of several sizes (those of the inner row about twice as tall and 3 times as broad at the base as those of the outer), 2 to 4 times as long as the anthers, broad at the base, filamentous in the upper third; anthers ovate-elliptical, posterior cells slightly smaller than the anterior; appendage to connective slightly shorter than the anther, blunt, furnished at the apex with a solitary (rarely two) long, fine hair. *Ovary* ovate, surmounted by a thick stylopodium, sericeous-tomentose; style cylindrical, short, glabrous; stigma minute. *Fruit* winged, stalk thin but prominent, about 3.0 mm. long; bases of calyx lobes slightly thickened, embracing the lower half of the nut, puberulous; wings papery, narrow at the base, minutely puberulous; the three outer about 7.0 × 1.0 cm., about 7-nerved; the two inner, linear, up to 5.0 cm. long, 1 to 3-nerved; nut subrotundate, about 1.0 cm. across, pale sericeous-tomentose, crowned by a long, slightly curved beak about 7.0 mm. long.

This species is a typical member of the *Eushorea* group of *Shorea*. In leaf texture and flower structure it is more like *S. sumatrana* (V. Sl. ex Foxw.) Sym. than any other species I have examined, but the fruits are of the normal winged *Shorea* type. The affinity of *S. Meadiana* with other members of the *Eushorea* group is entirely supported by the wood anatomy.

I have named the species after Mr. J. P. Mead, Director of Forestry, Straits Settlements and Adviser on Forestry, Federated Malay States, since 1929.

Collections examined:—

MALAY PENINSULA:

PERAK: Forest Dept. F.M.S. 11964, 16283, 21405, 21406, 24467, 24470, 24478, 24519, 24632, 24643, 25415, 25442, 25885, 28969, 28975, 29877, 29904, 29916, 29942, 32162, 33685, 33771, 33772, 40608, 43128.

KELANTAN: Forest Dept. F.M.S. 32820, 33290, 33425, 37844, 37974, 37976.

PAHANG: Forest Dept. F.M.S. 49845 (Type of *Shorea Meadiana* Sym.); C.F. Symington; Bukit Goh Forest Reserve, Kuantan, Pahang; 19th Nov., 1938; flower. Field notes—"Tree 4 ft 6 in. girth; bole and cut typical of a *balau*, inner bark reddish-brown; petals falling separately, greenish-yellow, broad at base, linear and revolute above, about .75 in. long; fallen flower buds also plentiful beneath tree".

Also—Forest Dept. F.M.S. 17224, 31751, 31752, 31761, 31762, 31763, 47138.

*Shorea Meadiana* has been collected in the Peninsula from time to time since 1928, when it was first recognized as one of the species called *damar laut kuning* in Keledang Saiong Forest Reserve in Perak. Owing to lack of flowers or good fruiting material it has not been possible to describe it until now, but it has been recognized as one of the species producing balau timber, and was referred to by Desch in *Mal. For. Rec.* 12: 9 (1936) as *"Shorea sp. nov."*. We have adopted the preferred vernacular name of *balau sengkawang,* for *Shorea Meadiana,* because the leaves are similar to those of *sengkawang,* (Shorea sumatrana), but smaller.

**Shorea submontana** Symington, **nom. nov.** *Shorea costata* King **(synon. nov.)** in Journ. Asiat. Soc. Bengal 62: 119 (1893); Brandis in Journ. Linn. Soc. (Bot.) 31: 81 (1895); Burkill in Journ. Str. Br. R. Asiat. Soc. 81: 67 (1920) et 86: 281 (1922); Ridley, Fl. Mal. Penins. 1: 231 (1922) partim; Foxw., Mal. For. Rec. 3: 67 (1927) et Mal. For. Rec. 10: 176 (1932) partim; Desch, Mal. For. Rec. 12: 9 (1936); non Shorea (Pterigium) costata (Correa de Serra) J. S. Preslem, Rostlinai 2: 66 (1825).

I am here renaming King's *Shorea costata* because his name is invalidated by the existence of an earlier homonym, *Shorea costata* J. S. Presl. (1825). *S. costata* J. S. Presl. is based on a plant called *Pterigium costatum* Correa de

Serra [*Ann. Mus. His. Nat. Paris* 8: 397 (1806) t. 6, fig. 1] which would appear, from the description, to be a species of *Dipterocarpus,* with which genus *Pterigium** is united by Bentham and Hooker (*Gen. Plant* 1: 191).In making the combination *Shorea costata,* Preslem cites *Pterigium costatum* Corr. and *Dryobalanops aromatica* Gaertn. f. as synonyms. It is obvious that he is wrong in uniting these species and in referring either to *Shorea* but the name *Shorea costata* J. S. Presl. is validated by the citation of these validly published names in synonymy†.

King founded his species *S. costata* in 1893, upon a single collection made by Curtis (No. 199) on Penang Hill. Brandis cited only this one collection and added nothing to our information concerning the species, except that he states that the stamens are 20 in number. Ridley cited two specimens from Penang—"Government Hill (Curtis) and Batu Feringhi".—and modified King's description. From the fact that he says "Petals nearly ovate, white, silky on both sides,, it appears that the Batu Feringhi specimen was a flowering collection of *Shorea Maxwelliana;* it may even have been a sheet of the collection upon which the species *Shorea alba* Ridl. (now reduced to *S. Maxwelliana* King) was founded.

In 1927 Foxworthy did not attempt to identify any particular collections with *S. costata,* but in 1932 he cited "with some doubt" S'pore Field No. 3476, 3495, 4316, and 4324. I agree with these citations with the exception of 3495, which I consider to be a rather large-leaved collection of *S. Maxwelliana.*

The original collection, upon which King founded his *S. costata,* bore young fruits and a few fragmentary flowers, concerning which King says—"Stamens 15, all with dilated filaments longer than the ovate anthers, those of the inner row with the apical process of the connective short and glabrous, those of the outer rows with longer ciliate apical connectives". My examination of a single flower of the same collection shows that the stamens are 20 in number and that all stamens have curved appendages about half as long as the anthers, each with 1–6 bristles. Brandis also reported 20 stamens. Unfortunately authentic flowering material has never since been collected, but the original collection is adequate to demonstrate that this species is a typical *Eushorea.* Desch's study of the wood anatomy of the species supports this conclusion.

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* Wrongly spelt *Pterygium* in some publications.

† I am very much indebted to Mr. C. E. C. Fischer of Kew for kindly looking up the references in connection with *S. costata* Presl. for me.

Until we have more adequate collections of flower and fruit of this species I shall not attempt to draw up a fuller description than that provided by King, modified by my remarks concerning the stamens. Unfortunately most of the specimens cited below are sterile and many consist only of leaves picked from the ground.

Collections examined:—

MALAY PENINSULA:

PENANG: Curtis 199 (Holotype of *S. costata* King in Herb. Kew); S'pore Field No. 3476, 4316, 4324, 4591; Forest Dept. F.M.S. 28033, 36635, 37852.

PERAK: Forest Dept. F.M.S. 16266, 24215, 25426, 25515, 25519, 25745, 25746, 25749, 25820, 28073, 28561, 28584, 28971, 28987, 28988, 29884, 32171, 32172, 32192.

SELANGOR: Forest Dept. F.M.S. 40770, 40772 to 40777 inclusive.

TRENGGANU: Forest Dept. F.M.S. 43079.

PAHANG: Forest Dept. F.M.S. 40513.

A dipterocarp, found in our high hill dipterocarp forests and producing timber of the balau grade is here considered to be the species described as *Shorea costata* by King in 1893. It is shown, however, that the name *Shorea costata* King is illegitimate according to the *International Rules of Botanical Nomenclature,* and a new name *Shorea submontana* is given to the species.

**Shorea ovalis** (Korth.) Bl., Mus. Bot. Lugd. Bat. 2: 33 (1852); Miq., Fl. Ind. Bat. 1, pt. 2: 503 (1859); A.DC. in DC. Prodr. 16, pt. 2: 631 (1864); Burck in Ann. Jard. Bot. Buitenz. 6: 219 (1887); Brandis in Journ. Linn. Soc. (Bot.) 31: 103 (1895); Merr., Bib. Enum. Born. Pl. 406 (1927). *Vatica ovalis* Korth. Verh. Nat. Gesch. Bot. 73 (1839–42); Walp. Repert 5: 127 (1845). *Vatica ? eximia* Miq., Fl. Ind. Bat. Suppl. 480: (1860). *Vatica ? sub-lacunosa* Miq., l.c. *Shorea eximia* (Miq.) Scheff. **(synon. nov.)**, Nat. Tijdschr. Ned. Ind. 31: 349 (1870); Burck in Ann. Jard. Bot. Buitenz. 6: 218 (1887); King in Journ. Asiat. Soc. Beng. 62, pt. 2: 121 (1893); V. Sl. ex Heyne, Nutt. Plant. Ned. Ind. ed. 2: 1116 (1927); Sym. in Gard. Bull. S.S. 7: 143 (1933) tab. 43. *Shorea sublacunosa* (Miq.) Scheff., l.c. (1870) 350. *Shorea fusca* Burck **(synon. nov.)** in l.c.: 207 (1887); Brandis in l.c. (1895) 83. *Shorea sericea* Dyer in Hook. f. Fl. Brit. Ind. 1: 306 (1872); King in l.c. (1893) 111; Brandis in l.c. (1895) 101, Becc. 2603 excl.; Ridl. in Agric. Bull. S.S. & F.M.S. 1: 58 (1901), et Fl. Mal. Penins. 1: 224 (1922); V. Sl. ex Heyne, l.c. ed. 1: 308 (1917); Burkill in Journ. Str. Br. R. As. Soc. 81: 73 (1920); Foxw., Mal. For. Rec. 1: 80 (1921), 3: 33 (1927), 8: 23 (1930), et 10: 229 (1932); ? Merr. Bib. Enum. Born. Pl. 406 (1927) excl. Becc. 2603; V. Sl. ex Merr., Plant. Elmer. Born. 204 (1929); Edwards, Mal. For. Rec. 9: 147 (1931). *Shorea rigida* Brandis in Hook. Ic. Pl. t. 2402 (1895) et in Journ. Linn. Soc. (Bot.) 31: 102 (1895); Burkill in l.c. 76: 164 (1917) et 81: 73 (1920); Ridl. in Agric. Bull. S.S. & F.M.S. 1: 58 (1901) et Fl. Mal. Penins. 1: 223 (1922); V. Sl. ex Heyne, l.c. edit. 1: 306 (1917) et edit. 2: 1124 (1927); Foxw., Mal. For. Rec. 3: 33 (1927). *Shorea furfuracea* sensu Brandis in l.c. (1895) 98, partim; sensu V. Sl. ex Heyne, l.c. edit. 1: 299 (1917) partim; non S. furfuracea Miq. *Dilleniacea ? nervosa* in Wall. Cat. 6635 (1828–49).

I have already investigated this species in some detail in *Gard. Bull. S.S.* 7: 143 (1933), under the heading *Shorea eximia* (Miq.) Scheff., which appeared at that time to be the legitimate name for it. I have since been fortunate in having the opportunity of examining, along with Dr. van Slooten, some of the early Dutch collections which I had not seen in 1933. This examination revealed that the type specimens of *Shorea ovalis* (Korth.) Bl. and *Shorea fusca* Burck are conspecific with *Shorea eximia* (Miq.) Scheff. Unfortunately a name-change is involved as *Shorea ovalis* has priority over *Shorea eximia.*

I have made the necessary adjustments to the synonymy and citations of literature.

I should like to record here the fact that, in the Malay Peninsula, two distinct forms of this species occur. The most widely distributed form has distinctly boat-shaped leaves (*vide Gard. Bull. S.S.* 7, plate 43) and relatively slightly longer petioles than the other form, which is common on Penang island, in the north of Perak, and along the east coast of Trengganu and Pahang. This second form rarely has boat-shaped leaves, is slightly smaller in all parts, and has stipules and stipule scars which are not quite amplexicaul, as they are in the first form. But it is by no means easy to allocate all herbarium specimens to one form or the other, particularly if immature, and in essential floral and fruit characters I can see no difference.

It would be helpful if varietal names could be given to these forms, but first it is desirable that the varietal status of the important early collections should be decided. This, unfortunately, I cannot do at the moment as only a few of these collections are now available to me. It is possible that the variety *angustifolia* of *Shorea sublacunosa,* established by Scheffer, should be given recognition.

What appears to be a third variety, or form, occurs in Brunei. It has very coarsely ferrugineus-hairy branchlets, but until more complete material is available its status must be doubtful.

Collections examined:—[Additional to those cited in *Gard. Bull. S.S.* 7: 145 (1933)].

MALAY PENINSULA:
Perak: Forest Dept F.M.S. 16812, 30812, 30822, 34202, 43450.
Kelantan: Forest Dept. F.M.S. 32714.
Selangor: Forest Dept. F.M.S. 38153, 40946, 40962 to 40965 inclusive, 45838.
Pahang: Forest Dept. F.M.S. 15622, 30135, 31526, 40316, 40442, 41017, 49847, 49848.
Malacca: Forest Dept. F.M.S. 25221.
SUMATRA (?): *s.n., leg.?* (in Herb. Lugd. Bat. (Holotype of *Shorea fusca* Burck.).
BILITONG: Teysmann *s.n.;* van Rossum No. 66 (341) fl. + fr.
JAVA: Cult. in Hort. Bog. VII–C–21.
BORNEO:
West Residency: Korthals *s.n.,* Prarawing, *ex* Herb. Lugd. Bat. (Holotype of *Vatica ovalis* Korth. and *Shorea ovalis* Bl.).
North Borneo: Elmer 21507, 21784.

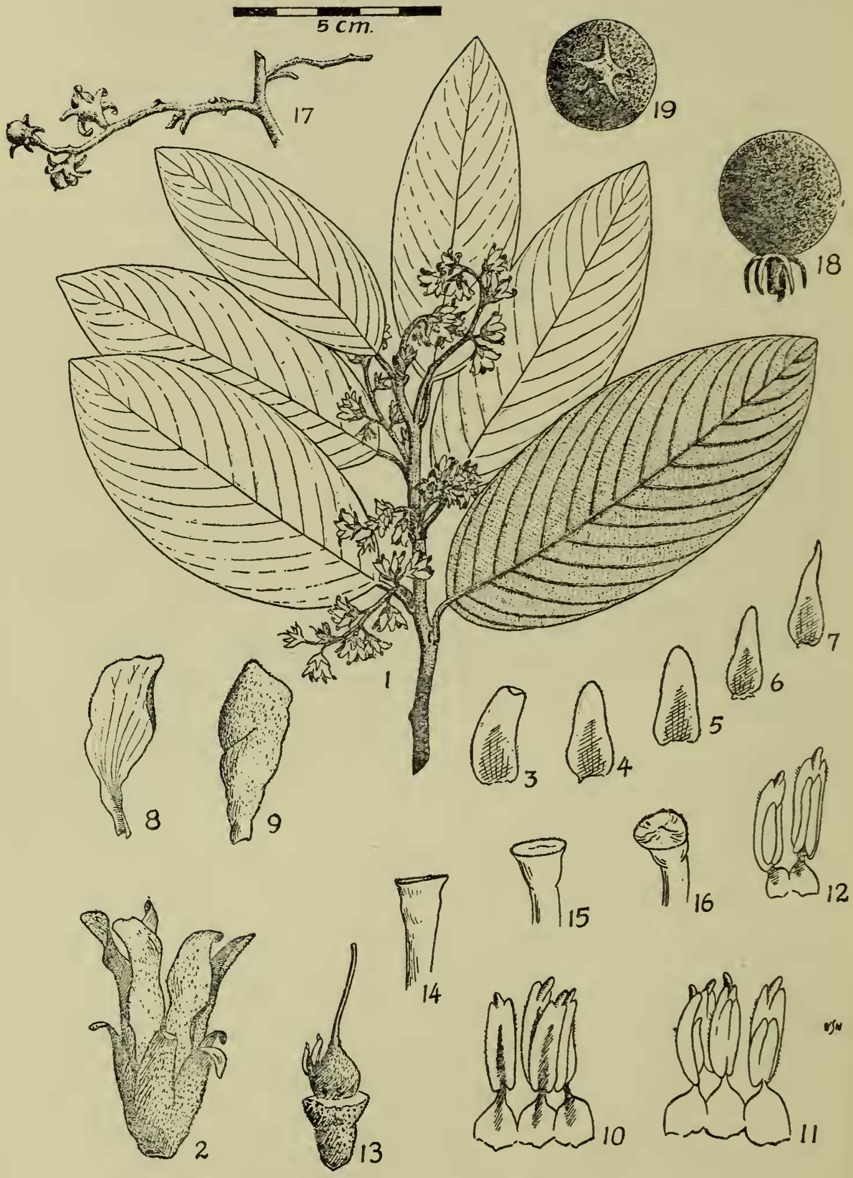
The botanical name of our *meranti kepong* is here changed from *Shorea eximia* to *Shorea ovalis*. The change is necessitated by the discovery that the first collection of the species to receive a name was given the epithet *ovalis* in 1842, eighteen years before the epithet *eximia* was applied to another collection of the same species.

**Shorea rugosa** var. **uliginosa** (Foxw.) Symington, **stat. nov.**
*"Shorea* sp.", Foxw., Mal. For. Rec. 3: 37 (1927). *Shorea uliginosa* Foxw., Mal. For. Rec. 10: 210 et 277 (1932). *Shorea rugosa* sensu Sym. in *Gard. Bull. S.S.* 7: 132 (1933) partim, et tab. XXXV; non Shorea rugosa Heim sensu stricto.

In 1933 I investigated the Malay Peninsula species *Shorea uliginosa* Foxw. and concluded that it was identical with the earlier-described *Shorea rugosa* Heim, from Borneo. Having since had the opportunity of examining more complete material, both in the herbarium and in the field, I consider that my conclusions require modification.

Foxworthy's *S. uliginosa* is apparently identical in flower structure and in texture with *S. rugosa* Heim, but there are these constant differences—*S. uliginosa* has slightly larger leaves with relatively longer petioles, and smaller, less hairy fruits. In field characters the two forms are very similar, but *S. uliginosa* appears to occur only in peaty swamp jungle while *S. rugosa* may occur on drier land. The most useful diagnostic field character is the cupping of the leaves, which in *S. uliginosa* is very pronounced and in *S. rugosa* is rarely evident.

I think a reasonable and satisfactory way of treating the problem is to consider *S. uliginosa* Foxw. as a variety of *S. rugosa* Heim, and I have given the synonymy of *S. rugosa* var. *uliginosa* accordingly.



*Parashorea densiflora* V.Sl.et Sym.

Collections examined:—

*Shorea rugosa* Heim (sensu stricto).

BORNEO:

SARAWAK: Beccari 2638 and 2890 (Syntypes of *Shorea rugosa* Heim *ex* Herb. Beccari; iso-syntypes *ex* Herb. Kew); Forest Dept. Sarawak No. 00264.

*Shorea rugosa* var. *uliginosa* (Foxw.) Sym.

MALAY PENINSULA:

[Additional to these cited in *Gard. Bull. S.S.* 7: 133 (1933)].

PERAK: Forest Dept. F.M.S. 27058, 28617, 28618, 31052, 32883 to 32888 inclusive, 34103, 34104, 34105, 34108, 34109, 34155, 38001, 38120, 38131 to 38138 inclusive, 38143, 40847.

SELANGOR: Forest Dept. F.M.S. 13123, 13131 to 13134 inclusive, 13140, 17042, 29238, 29244, 29245, 29743, 30265, 41680, 41681, 46309.

BANGKA: Grashoff No. 65.

JAVA: ? Cult. in Hort. Bog. VII—C—22.

BORNEO:

SARAWAK: Haviland 2252; Sarawak Museum No. 9 and *s.n.* (Aug. 1908).

The Malay Peninsula tree called *meranti bakau* was named *Shorea uliginosa* Foxw. in 1932. In 1933 I considered that our species was identical with the earlier described *S. rugosa* Heim, but examination of more material has induced me to change my opinion. Our tree is very closely related to the Bornean *S. rugosa* but there are slight, definable differences; the most satisfactory arrangement seems to be to treat *S. uliginosa* as a variety of *S. rugosa*. Thus our *meranti bakau* becomes *Shorea rugosa* var. *uliginosa* (Foxw.) Sym.

**Parashorea densiflora** van Slooten et Symington, **sp. nov.**

*Parashorea aptera* sensu Foxw., Mal. For. Rec. 10: 243 (1932); non P. aptera V. Sl. in Bull. Jard. Bot. Buitenz. III, 8: 377 (1927) **Plate 24.**

*P. apterae* V. Sl. similis, sed foliis tomentosis, fructus calycis laciniis reflexis satis distincta.

*Branchlets* pale fulvous tomentose towards the ends, later glabrous and dark. Leaves usually elliptic- or oblong-lanceolate, acute or acuminate at the apex, rounded at the base or sometimes unequal, one side being cuneate, about 11.0 × 4.75 cm. but considerably variable, glabrous and drying greenish-yellow on the upper surface, fulvous scabrous stellate-tomentose on the lower; midrib inconspicuous above, prominent and stellate-hairy beneath; main nerves about 12 to 16 pairs, faint above, prominent and hairy beneath, joined by conspicuous scalariform reticulations; petioles about 12.0 mm. long, rugose, tomentose; stipules caducous (not seen), leaving small triangular scars. *Panicles* terminal or in the axils of the uppermost leaves, short and dense (2.0–6.0 cm. long), the branchlets only a few mm. long and few-flowered. *Flowers* about 9.0 mm. long, sessile or shortly stalked, subtended by caducous bracteoles; pedicel, calyx, and petals pale tomentose on the exposed portions. *Sepals* tomentose outside; three outer ovate-oblong, obtuse; two inner slightly smaller and acuminate. *Petals* rather broad, narrow at base, said to be "yellow outside, purple inside" (Forest Dept., F.M.S. 12680). *Stamens* 15, in three rows, the inner row slightly taller than the two outer rows which are subequal; filaments short, flattened, broad at base, narrowing abruptly; anthers oblong, about twice as long as the filaments, the outer cells longer than the inner and furnished with a few (sometimes tufted) setae; appendage to connective short and blunt, prolonged slightly beyond the apex of the outer anther cells. *Ovary* ovate-rotundate, hairy, the apex prolonged into a long, filiform, glabrous style, stigma discoid, apparently ringed with minute hairs, obscurely lobed. *Fruit* a 5-lobed, globose nut: stalk up to 7.0 mm. long, smooth or sparsely stellate-hairy; calyx-lobes usually 5 (sometimes 6 or 4), valvate, subequal, woody, oblong, up to 12 mm. long, slightly or markedly reflexed, glabrous when mature; nut free, globose, about 3.0 cm. across when mature, minutely apiculate, verrucose. *Seedlings* have linear leaves, and saplings large, glabrous, glaucous, long-petioled leaves characteristic of *Parashorea.*

This species, which was first collected in 1925, was referred by Foxworthy, in 1932, to van Slooten's *Parashorea aptera.* Undoubtedly it is a close relative of that species, but it differs markedly in the smaller, more tomentose leaves, and the reflexed fruiting calyx-lobes (flowers of *P. aptera* V. Sl. are not known). I am indebted to Dr. van Slooten for confirming my suspicion that our species is distinct, and for suggesting the name *Parashorea densiflora.*

In addition to the specimens cited below we have several collections, mainly from eastern Pahang, which differ from typical *P. densiflora* in the glabrous leaves, and in some other respects. These may represent a separate species, but until adequate herbarium material is available I shall refer to them as "the glabrous form of *P. densiflora*".

Collections examined:—

MALAY PENINSULA:

SELANGOR: Forest Dept. F.M.S. 12845, 13302, 18161, 23100, 23336, 24059, 24172, 29458, 29459, 30056, 30057, 32158, 32378.

NEGRI SEMBILAN: Forest Dept. F.M.S. 12680 (Type of *P. densiflora* V.Sl. et Sym.) E. A. Strouts; Senaling Inas Forest Reserve; March 17th, 1927; flower (first consignment) and young fruits (second consignment). Field note—"flower yellow outside, purple inside".

Also—Forest Dept. F.M.S. 10343, 26620, 42754, 42966.

PAHANG: Forest Dept. F.M.S. 40422.

*Parashorea densiflora* is the name here given to our *meranti pasir.* Formerly the species was confused with *Parashorea aptera,* a closely related species described from Sumatra, but so far not recorded from the Malay Peninsula.

✓ **Parashorea globosa** Symington, **sp. nov.**

*P. densiflorae* V. Sl. et Sym. probabiliter affinis, sed foliis fructibusque majoribus differt.

*Branchlets* rather coarse, coarsely yellow stellate-tomentose towards the ends. *Leaves* ovate to elliptic-oblong, rounded or subcordate at the base, bluntly acuminate at the apex, about 12.0 × 7.0 cm. to 20.0 ×9.0 cm., glabrescent and drying a pale yellow or greenish tinge on the upper surface, densely golden tomentose or sparsely hairy and glaucescent beneath; midrib slightly depressed and hairy above, prominent and coarsely stellate-hairy beneath; main nerves 16 to 20 pairs, faint on the upper surface, prominent and stellate-hairy beneath; reticulations scalariform, prominent and hairy on the lower surface; petioles coarse, rugose, tomentose, thickened above, about 1.5–2.0 cm. long. *Inflorescence* and *flowers* unknown. *Fruit:* stalk stout, 3.0 mm. long; nut globose, verrucose, about 4.0 cm. across, free; calyx lobes 5 (or 6), valvate, subequal, linear-oblong, 1.0–2.0 cm. long, not reflexed. *Seedlings leaves* very large, peltate, acuminate, silvery beneath, with long slender petioles.

This species is very imperfectly known. Flowers have never been collected, and the only fruits to be found had so rotted on the ground that they broke into fragments shortly after collection. Its leaves are very like those of *Parashorea densiflora* V. Sl. et Sym., but much larger. They closely resemble those of *Parashorea Buchananii* (Fischer) Sym. (**comb. nov.** = *Shorea Buchananii* Fischer), but they are much more hairy.

Collections examined:—

MALAY PENINSULA:

PERAK: Forest Dept. F.M.S. 16823 (Type of *P. globosa* Sym); D.B. Arnot; Bruas Forest Reserve, flat land beside swamp; 24th March, 1935; sterile. Field note—"Tree 70 ft high, 9 ft 6 in. girth".

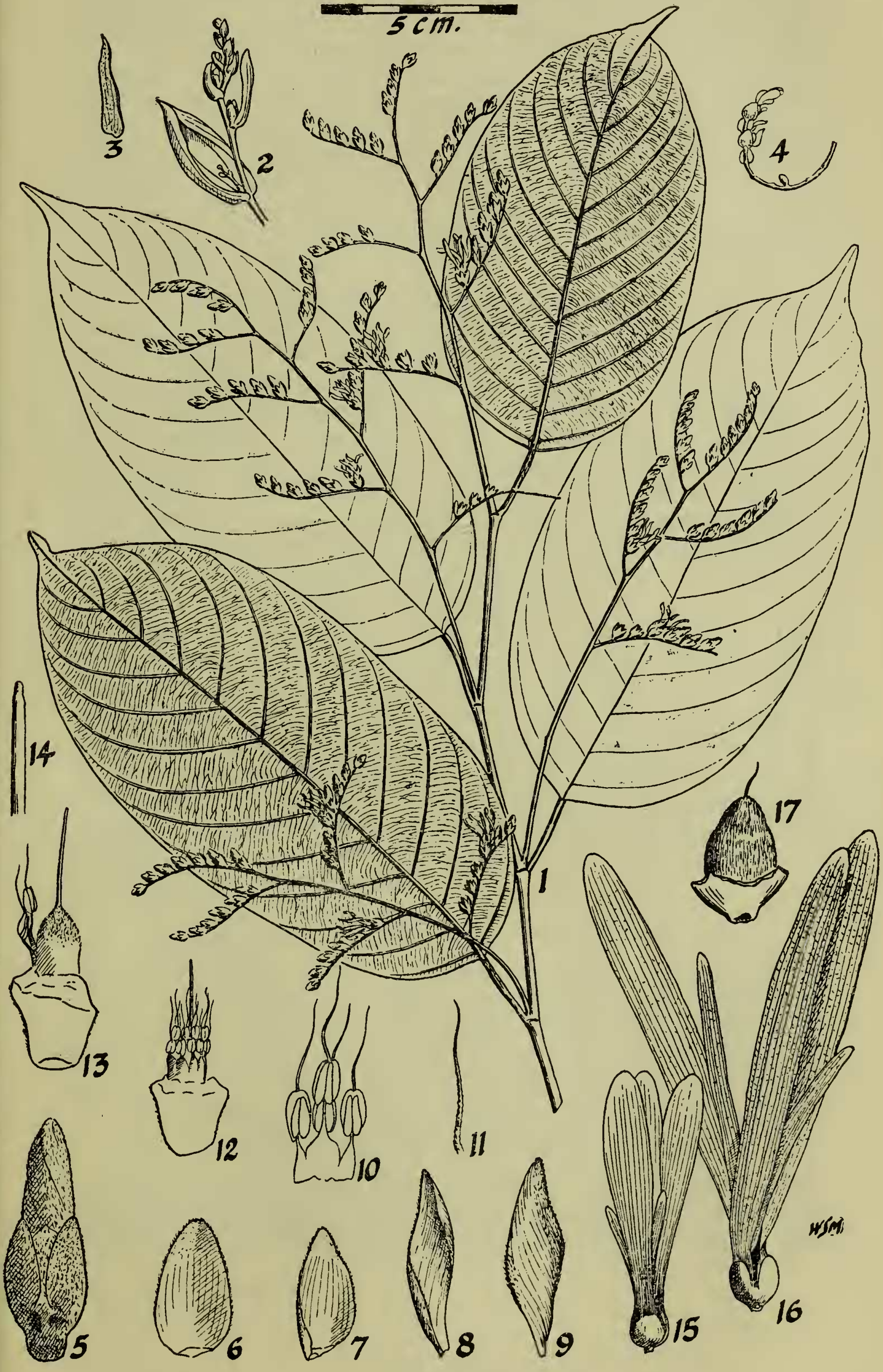
Also—Forest Dept. F.M.S. 16272, 16819, 16824, 16825, 24642, 25414, 25645, 43598 (fruit).

*Parashorea globosa* is the name here given to a rather rare tree which is known to occur in valleys on the east of the Keledang Saiong Forest Reserve, and in the north west of Bruas Forest Reserve in Perak. In leaves and fruits it resembles *meranti pasir* (Parashorea densiflora) but all parts are larger. No recognized vernacular name is known but the name *meranti pasir daun besar* has been coined.

**Shorea leptoclados** Symington, **sp. nov.** *Shorea polysperma* sensu Keith, N.B. For. Rec. 2 (Prelim. List N.B. Pl. Names) : 238 (1938) ; non S. polysperma (Blco.) Merr. **Plate 25.**

*S. polyspermae* (Blco.) Merr. valde affinis sed foliis latioribus basi obtusis differt.

*Branchlets* rather fine, cinereous and minutely stellate-hairy towards the ends, later black and glabrescent. *Buds* prominently stalked. *Leaves* elliptical, shortly blunt-acuminate at the apex, rounded at the base, about 9.0 × 4.25 cm. to 16.0 × 8.0 cm., glabrous or sparsely minutely stellate-hairy above, minutely stellate-hairy on the veins on the undersurface, usually drying ash-grey or grey-brown in colour; midrib slightly depressed above, prominent and stellate-hairy beneath; main nerves 9 to 15 pairs, faint above, fine but conspicuous on the lower surface, usually with domatia in the axils of the two lowest pairs; tertiary nerves joining the main nerves in very fine, more or less parallel, wavy lines, usually invisible to the naked eye on the upper surface; petioles slender, about 1.75 cm. long, minutely stellate hairy, drying black or cinereous; stipules linear, up to 2.0 cm. long, caducous, leaving rather prominent scars. *Panicles* terminal or in the axils of the youngest leaves, solitary, slightly shorter than the leaves, very slender, minutely stellate-hairy to cinereous-tomentose towards the ends; branchlets slender, sometimes zig-zag, up to 4.0 cm. long, 3 to 17-flowered (usually about 9), arranged at intervals of about 1.0 cm. and each subtended by linear-oblong, minutely tomentose, subpersistent, stipular bracts. *Flowers* subtended by ovate, minutely tomentose, slightly imbricate, paired bracteoles, secund, ovate-lanceolate and about 8.0 mm. long in bud, closely set, "grey" (38841), "yellow ochre" (36724), "white" (38861). *Sepals* subovate, rounded or subacute at apex, the three outer slightly larger than the two inner, densely pale stellate-tomentose outside, minutely tomentose on the apical portion inside. *Petals* linear-oblong, sericeous tomentose on the portions exposed in bud. *Stamens* 15, arranged in three rows in the normal manner; filaments broad and flattened at the base, abruptly narrowing to the filamentous upper half; anthers elliptical-oblong, shorter than the filaments, 4-celled; appendage to connective filiform, as long as the



*Shorea leptoclados* Sym.

filament and anther, sometimes minutely papillose. *Ovary* subglobose, densely tomentose except at the base; style filiform, erect, about twice as long as the ovary; stigma minute. *Fruit* 5-winged, (immature specimens only seen); almost sessile; bases of accrescent sepals embracing the entire nut, woody, sparsely minutely stellate-hairy; wings thin, puberulous; three outer 6.0–12.0 cm. long by about 1.4 cm. broad, about 10-nerved; two inner wings narrow, up to about 5.0 cm. long; nut ovate, about 1.0 cm. long, constricted near the apex, crowned with the thin stylar remnant, pale sericeous-tomentose.

*Shorea leptoclados* is very closely related to *S. pauciflora* King and *S. polysperma* (Blco.) Merr. All three are very similar in vegetative characters, while the flower and fruit structure is essentially the same. *S. pauciflora* is, however, distinguishable from the other two by its minutely setose antherine appendages. *S. polysperma* differs from *S. leptoclados* in having more lanceolate leaves, which are frequently scurfy-lepidote, and in the more densely tomentose panicle. It seems probable that the most reliable diagnostic character will be revealed after comparison of the floral bracts, but the material available to me is hardly adequate for definition of the differences.

Other related species, less liable to be confused with *S. leptoclados,* include *S. palembanica* Miq., *S. Kunstleri* King, *S. platyclados* V.Sl., *S. singkawang* Miq., *S. inaequilateralis* Sym., and several undescribed Bornean species. These form a natural group which corresponds closely to Heim's Section *Brachyptera.* For convenience I shall in future refer to this group as the "*Brachyptera* Group" as the name *Brachyptera* will probably eventually have to be adopted, although it is admittedly not very appropriate.

Collections examined:—

MALAY PENINSULA:

JOHORE: Forest Dept. F.M.S. 35758, 35759.

BORNEO:

BRUNEI: Forest Dept. F.M.S. 30533 (Type of *S. leptoclados* Sym.); J. S .Smith; Sungei Batu Apoi, river bank; 22nd April, 1935; flower. Field notes—"Vern. name *serigawan plandok* (Murut); tree 100 ft high, 5 ft girth; bark purplish, smooth (very variable it seems)". Also—Forest Dept. F.M.S. 30529, 35672, and 39605.

NORTH BORNEO: Forest Dept. F.M.S. 36724 (S.H. 3947), 38776 (S.H. 4400), 38804 (S.H. 4428), 38841 (S.H. 4465), 38861 (S.H. 4485), 39005 (S.H. 4629).

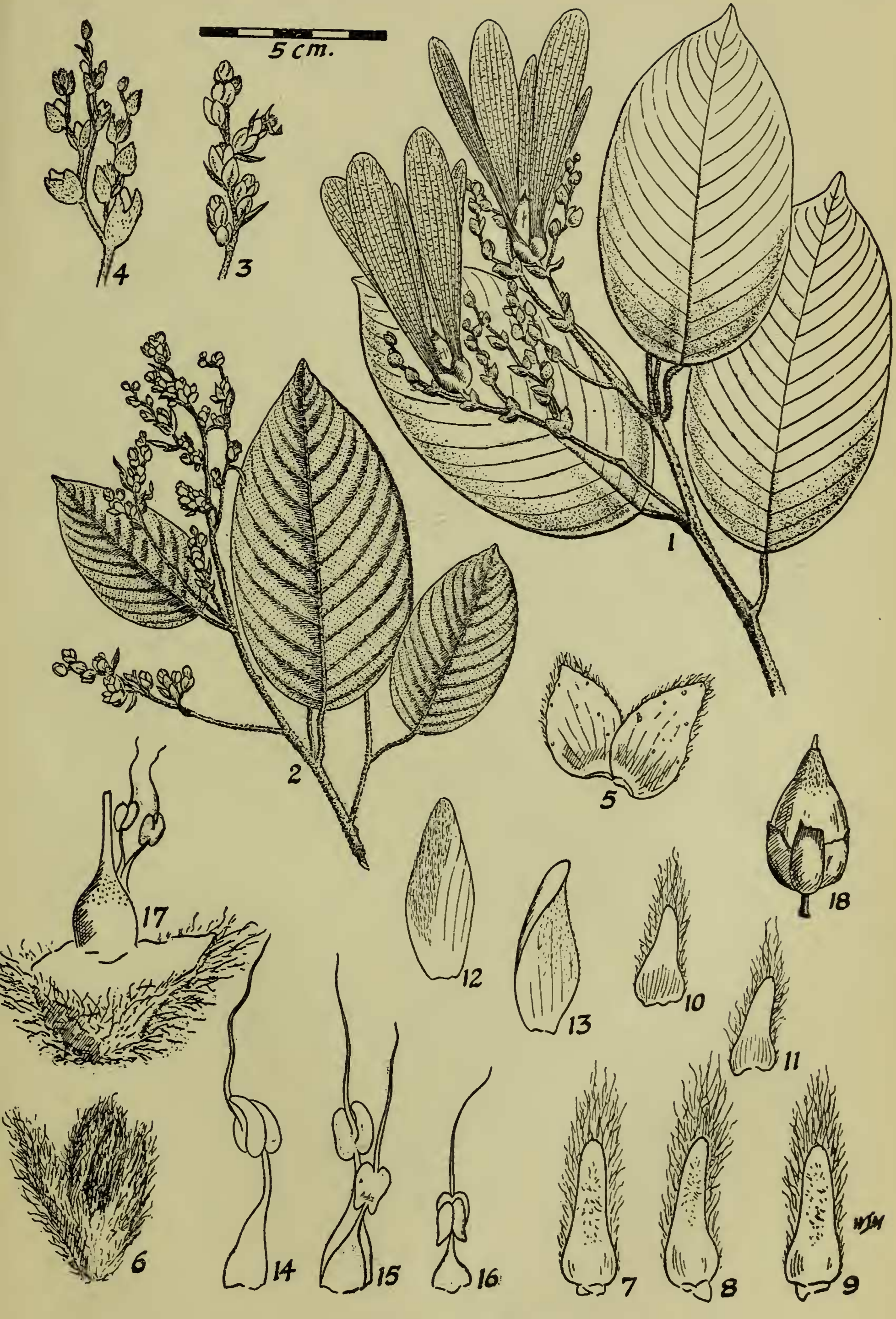
The tree here described as *Shorea leptoclados* is well-known in North Borneo as *majau.* In Brunei it has been recorded under the name of *seringawan plandok,* and in the

Malay Peninsula it has recently been located in Panti Forest Reserve where it is given the name *meranti pepijat.* Botanically it is closely related to *tanguile* (S. polysperma) of the Philippines, and *nemesu* (S. pauciflora) which is well-known in the Malay Peninsula. It produces light red meranti timber. In the field it is readily recognizable by its greyish-coloured bole and outer bark shedding in thin papery flakes.

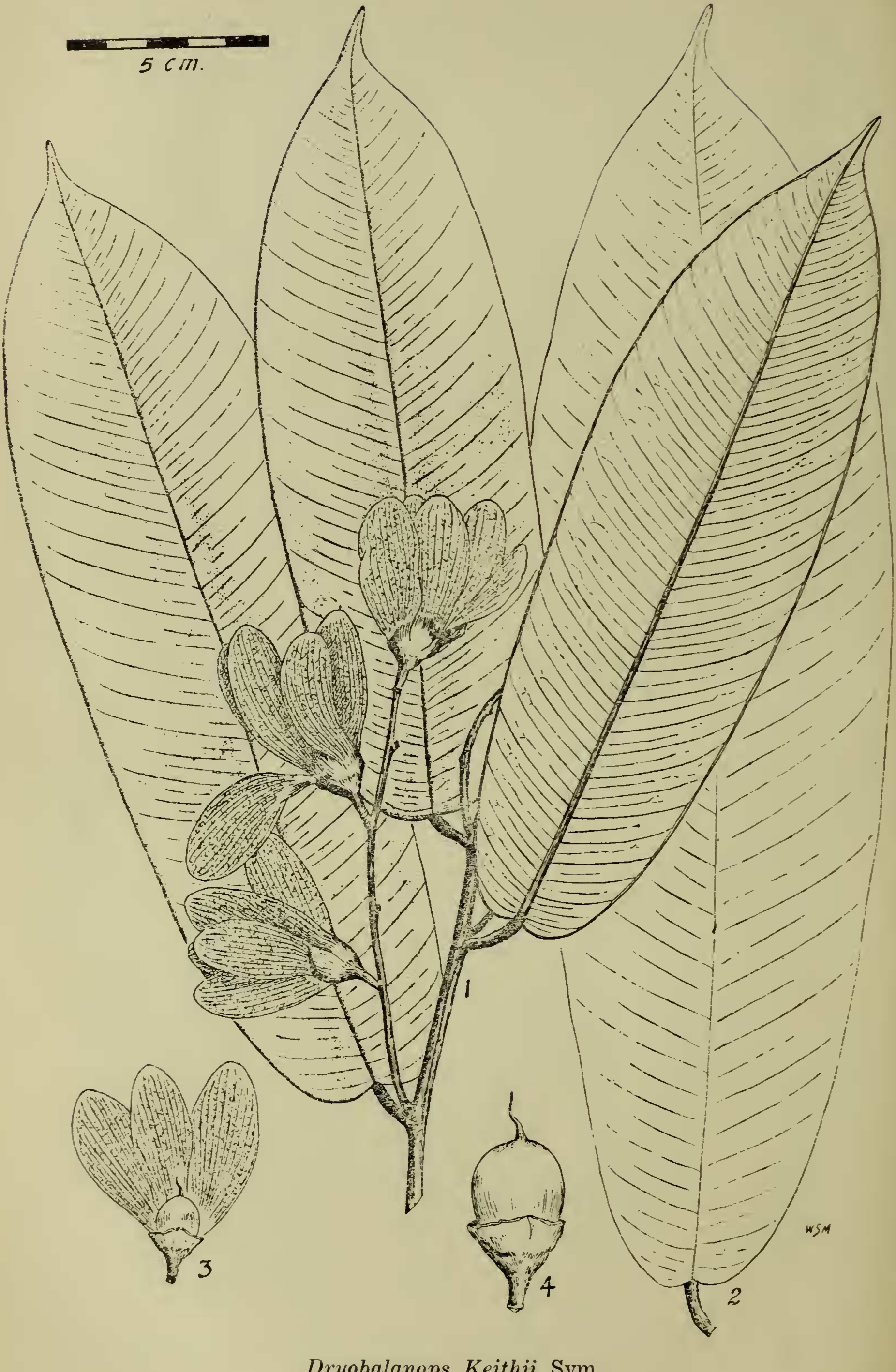
**Shorea Flemmichii** Symington, **sp. nov. Plate 26.**

*S. Gysbertsianae* Burck et *S. stenopterae* Burck, inter alia, probabiliter affinis, sed indumento ramulorum foliorumque scaberrimo, bracteis persistentibus parvis, floribus lanuginosis, omnibus partibus minoribus valde distincta.

*Branchlets* rather thin but coarsely, fulvous, scabrous stellate-hairy. *Leaves* elliptical or ovate-elliptical, acute or shortly acuminate at the apex, rounded or subcordate at the base, about 8.0 × 3.4 cm. to 11.0 × 5.5 cm., margins sometimes slightly revolute, deciduous stellate-hairy and drying reddish-brown on the upper surface, scabrous fulvous stellate-tomentose on the lower; midrib slightly depressed and tomentose on the upper surface, prominent and scabrous beneath; main nerves 14 to 20 pairs, very faint above but prominent and scabrous beneath; nervules joining the main nerves in wavy, more or less parallel, lines, almost invisible above, marked by rows of stellate hairs on the lower surface; petioles about 1.5 cm. long, scabrous, fulvous stellate-hairy. *Panicles* terminal or in the axils of the upper leaves, of solitary racemes up to about 8.0 cm. long, fulvous, scabrous stellate-tomentose; branchlets subtended by 3-fid bracts, up to 2.5 cm. long and rather prominently zig-zag when mature, each bearing 3 to 5 distichous flowers. *Flowers* subsessile, about 5.0 mm. long in bud, each subtended by imbricate, paired bracteoles; bracteoles ovate, acute, irregularly crenate at the margins, about 5.0 mm. long, lanate-hairy on the outer surface, sparsely gland-dotted, persistent. *Sepals* ovate-linear-oblong, lanate-tomentose, the three outer about twice as long as the two inner. *Petals* oblong, lanate-tomentose outside, minutely tomentose on the inner surface. *Stamens* 15, in three rows; filaments broad and flattened at the base, narrow in the upper half, two to three times as long as the anthers; anthers oblong-globulose, the 4 cells subequal; appendage to connective filiform, rather longer than the filament and anther. *Ovary* and stylopodium ovate-conical, minutely glandular-papillose in the upper portion; style erect, cylindrical, glabrous, about as long as the ovary and stylopodium;



*Shorea Flemmichii* Sym.



*Dryobalanops Keithii* Sym.

stigma minute. *Fruit* 5-winged; stalk 2.5 mm. long, lanate-hairy; bases of accrescent sepals embracing the lower third of the nut, slightly thickened, sparsely lanate-hairy at the base; wings papery, glabrous; three outer spathulate, obtuse, about 7.0 × 1.7 cm., about 9-nerved; two inner 5.0 to 6.0 cm. long, sometimes pointed at the apex, about 7-nerved; nut ovate-conical about 1.7 × .9 cm., sericeous-tomentose towards the apex which is surmounted by the thin, glabrous style about 2.0 mm. long.

I have likened this species to *S. Gysbertsiana* Burck and *S. stenoptera* Burck because of certain floral resemblances, but I do not pretend to believe that there is a very close relationship. Indeed, I have examined no dipterocarp with which *S. Flemmichii* is obviously closely related, but it belongs to that large heterogeneous group of *Shorea*, members of which have usually been referred to the section *Pinanga* Brandis.

I have named the species after Mr. C. O. Flemmich who has been State Forest Officer in Brunei since 1936 and has collected a large amount of excellent herbarium material from the trees in his state.

Collections examined:—

BORNEO:

BRUNEI: Forest Dept. F.M.S. 32585 (Type of *S. Flemmichii* Sym.); C. O. Flemmich; Bukit Ratan, Tenajor, Belait, hill slope; 21st March, 1938; flower buds. Field notes —"vern. name *meranti;* tree 120 ft high, 15 ft girth; flower immature".

Also—Forest Dept. F.M.S. 34576, 35540, 48110.

*Shorea Flemmichii* is the name here given to a new Brunei species which has been collected in hilly jungle at Tenajor, Pak Gabah, at Pangkalan Ran on the Tutong River, and in the Labi Hills Forest Reserve. The species, which is of considerable botanical interest, is remarkable in the field for its very thick, deeply-fissured bark. We were told that the Dyak name for the tree is *kayu raya*. The timber, as far as may be judged from a small sample, is a superior quality dark red meranti.

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**Dryobalanops Keithii** Symington, **sp. nov. Plate 27.**

A congeneribus foliis multo majoribus valde distincta; fructibus iis *D. fuscae* V. Sl. subsimilibus.

*Branchlets* rather coarse, smooth, drying dark purple-brown, prominently sparsely lenticellate; decurrent leaf traces and triangular stipular scars conspicuous. *Leaves* oblong, slightly broader towards the apex than at the base, about 20.0 × 6.5 cm. to 40.0 × 11.0 cm.; apex acuminate, acumen about 1.0 cm. long; base cordate; margins tending to be recurved at the base; glabrous, drying a light yellow or reddish-brown on both surfaces; midrib sunk on the upper surface, prominent and rounded on the lower; main nerves about 30 pairs, separated by one slightly shorter but hardly less prominent intermediate nerve and several shorter ones, joining to form a prominent intramarginal nerve close to the leaf margin, very faint on the upper surface but prominent on the lower; petioles about 1.0 cm. long, thick, rugose, and dark when dry. *Panicles* glabrous, apparently of solitary racemes about half as long as the leaves, furnished with caducous bracts and semi-persistent, paired bracteoles which subtend the flowers. *Flowers* unknown. *Fruits* (immature) winged, glabrescent; stalk about .5 cm. long; 5 calyx lobes equal, elliptic-obovate, about 4.5 × 2.3 cm., obtuse at the apex, about 14-nerved; nut subglobose, about 1.0 cm. long, sparsely hairy towards the apex, crowned by a tapering style about 0.4 cm. long.

Only immature fruits are known, but the species has such large and distinctive leaves that it can be described with confidence. Any further evidence of the generic position of the plant considered necessary is provided by the timber, which Mr. Desch, who has kindly examined it for me, reports to be typical of *Dryobalanops.*

I have named the species after Mr. H. G. Keith, Conservator of Forests, North Borneo, whose botanical collections are well-known to botanists interested in the flora of Borneo.

Collections examined:—

BORNEO:

NORTH BORNEO: Forest Dept. F.M.S. 44382 (S.H. 9070) (Type of *Dryobalanops Keithii* Sym.); H. G. Keith (Kalabakang-Kwamut Expedition); Tiaggau, edge of streams; 6th June, 1938; immature fruits. Field notes —"Vern. names *mampahit, gempait;* tree 40 ft high, 30 in. girth; fruits yellow-green, 5-winged similar to *kapur;* wood probably sold as *keruing,* sinking timber." Also—Forest Dept. F.M.S. 44381 (S.H. 9069).

DUTCH SOUTH and EAST BORNEO: bb. 17813, 18159.

The species here described as *Dryobalanops Keithii* appears first to have been collected by collectors of the Netherlands Indies Forest Department in Dutch East Borneo, in 1930, under the name of *malampait.* The first fertile collection was made in 1938 by Mr. Keith in North Borneo, where the tree is known as *gempait* or *mampahit.*

## Corrigenda

*Gard. Bull. S.S.* 7, pt. 2 (1933), p. 143, under "Collections examined, Borneo"—add Beccari 2960.

l.c., p. 150, top line—"Beccari 2960" should be deleted. On examination of the Milan sheet of this collection I see that it is actually *S. gibbosa* Brandis, although Brandis included it under *S. Faguetiana*. Heim based *S. Faguetiana* on Becc. 3039 and 2954 which are the syntypes; Becc. 2566 and 2960 were added later by Brandis.

*Gard. Bull. S.S.* 8, pt. 1 (1934), p. 4, second last line—for "6 cm.", read "4 to 5 cm."

l.c., p. 23, under "Collections examined, Siam" —delete C.F. 3761, 3835, 3863, and 3874. These sterile specimens all belong, I think, to *Hopea minutiflora* Fischer which is closely related to *H. sangal* Korth.

l.c., p. 26, line 3—delete "Type of young fruit".*

l.c., p. 26, line 6—for "Type of flower", read "Type of *Hopea semicuneata* Sym.".

l.c., p. 36, line 4—after No. 1343, insert "(Type of *Vatica dulitensis* Sym.)".

l.c., p. 40, second last line—for "drawings of flower parts" etc., substitute "(Drawings of 1 and flower parts based on Richards 1343; 2, 13, and 14 on Richards 2543)"

*Gard. Bull. S.S.* 8, pt. 4 (1935), p. 266, middle of page—for "*Shorea melaanonan* Bl.", read "*Shorea malaanonan* Bl."

l.c., p. 270, line 3—for "Type of flower", read "Type (flower)".

l.c., p. 270, line 6—for "Type", read "Paratype".

l.c., p. 274, line 7—for "Type", read "Paratype".

l.c., p. 274, line 8—for "Type of flower", read "Type (flower)".

l.c., p. 278, para. 3, line 3—for "Type of flower", read "Type".

l.c., p. 278, para. 3, second last line—for "Type", read "Paratype".

l.c., p. 283, para. 3, line 2—for "Type", read "Paratype".

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* In some of my earlier descriptions I have been somewhat ambiguous in designating the TYPE SPECIMEN. To avoid such ambiguity in future, I propose to employ, when it seems desirable to do so, the nomenclature of types proposed by Furtado in *Gard. Bull. S.S.* 9: 285–308 (1937).

l.c., p. 283, para 4, line 1—for "Type of flower", read "Type".
l.c., p. 285, para. 3, line 1—for "Type", read "Paratype".
l.c., p. 285, para. 3, line 1—for "Type of flower", read "Type".
l.c., p. 287, para. 2, line 1—for "Type of flower", read "Type".
l.c., p. 287, para. 3, line 1—for "Type", read "Paratype".
l.c., p. 288, last line—for "Type of flower", read "Type".
*Gard. Bull. S.S.* 9, pt. 4 (1938), p. 344, line 9—for "5.0 cm.", read "5.0 mm.".

## EXPLANATION OF PLATES

Plate 11. **Hopea minima** Sym. var. **penangiana** Sym. 1, flowering twig. 2, part of branchlet of panicle with two flower buds. 3, end of branchlet of panicle with expanding flower. 4 and 5, outer sepals. 6, 7, and 8, inner sepals. 9 and 10, petal from mature flower. 11, 12, and 13, stamens. 14, ovary. 15, end of branchlet of panicle showing paired bracteoles. 16, section through ovary. 17, fruiting branchlet. 18, fruit. 19, undersurface of leaf enlarged to show veination. (Drawings based on Curtis 1406). *Scale applies to 1 and 17 only.*

Plate 12. **Hopea subalata** Sym. 1, flowering twig. 2, branchlet of panicle showing paired bracteoles. 3, flower bud. 4, expanding flower. 5 and 6, outer sepals. 7, 8, and 9, inner sepals. 10 and 11, petal from mature flower. 12, 13, and 14, stamens. 15, ovary. 16, fruiting panicle. 17, enlarged fruit. (Drawings of 1 and flower parts based on Forest Dept. F.M.S. 13045; 16 and 17 on Forest Dept. F.M.S. 24921). *Scale applies to 1 and 16 only.*

Plate 13. **Hopea sublanceolata** Sym. 1, flowering twig. 2, branchlet of panicle and flower bud. 3, mature flower. 4, part of branchlet of panicle showing bracteoles. 5 and 6, outer sepals. 7, 8, and 9, inner sepals. 10 and 11, petal from flower bud. 12, stamens. 13, ovary. 14 and 15, fruits. (Drawings of 1 and flower parts based on Forest Dept. F.M.S. 30808; 14 on Forest Dept. F.M.S. 42292; 15 on Forest Dept. F.M.S. 12070). *Scale applies to 1, 14, and 15 only.*

Plate 14. **Hopea Griffithii** Kurz. 1, flowering twig. 2, branchlet of panicle with flower. 3, flower bud. 4, expanded flower. 5 and 6, outer sepals. 7, 8, and 9, inner sepals. 10 and 11, stamens. 12 and 13, petal from mature bud. 14, ovary. 15, fruiting twig. 16, fruit showing nut. (Drawings of 1 and flower parts based on Ridl. 4738; 15 and 16 on Forest Dept. F.M.S. 17402). *Scale applies to 1 and 15 only.*

**Plate 15.** **Hopea dryobalanoides** Miq. 1, flowering twig. 2, branchlet of panicle with flowers in three stages. 3 and 4, outer sepals. 5, 6, and 7, inner sepals. 8 and 9, petal from mature, flower. 10, 11, 12, and 13, stamens. 14, ovary. 15, section through ovary. 16, branchlet with immature fruits. 17 and 18, mature fruits. (Drawings of 1, 2, and flower parts based on Forest Dept. F.M.S. 625; 16 on Forest Dept. F.M.S. 23794; 17 and 18 on Forest Dept. F.M.S. 17345). *Scale applies to 1, 16, 17, and 18 only.*

**Plate 16.** **Hopea myrtifolia** Miq. 1, flowering twig. 2, immature twig. 3, flower bud. 4 and 5, outer sepals. 6, 7, and 8, inner sepals. 9 and 10, petal from mature bud. 11, 12, and 13, stamens. 14, 15, and 16, ovary and stylopodium. 17 and 18, mature fruits. (Drawings of 1 and flower parts based on Forest Dept. F.M.S. 41016; 2 on Miq. *s.n.;* 17 and 18 on Forest Dept. F.M.S. 41915). *Scales applies to 1, 2, 17, and 18 only.*

**Plate 17.** **Hopea ferruginea** Parijs. 1, flowering twig. 2, branchlet of panicle with young flower bud. 3, mature flower bud. 4 and 5, outer sepals. 6, 7, and 8, inner sepals. 9 and 10, petal. 11 and 12, stamens. 13, ovary. 14, end of style and stigma. 15, branchlet with mature fruits. 16, nut of mature fruit. (Drawings of 1, 2, and flower parts based on Forest Dept. F.M.S. 25285; 15 and 16 on Forest Dept. F.M.S. 9510). *Scale applies to 1 and 15 only.*

**Plate 18.** **Hopea Dyeri** Heim. 1, flowering twig. 2, flower bud. 3, branchlet of panicle. 4 and 5, outer sepals. 6, 7, and 8, inner sepals. 9 and 10, petals. 11, 12, and 13, stamens. 14, ovary and stylopodium. 15, fruiting twig. 16, nut of mature fruit. (Drawings 1 to 14 based on Forest Dept. F.M.S. 48026; 15 and 16 on Forest Dept. F.M.S. 1907). *Scale applies to 1 and 15 only.*

**Plate 19.** **Hopea micrantha** Hook. f. 1, flowering twig. 2 and 3, flower buds. 4, 5, and 6, inner sepals. 7 and 8, outer sepals. 9 and 10, petal from flower bud. 11 and 12, stamens. 13, ovary. 14, section through ovary. 15, fruits (slightly immature). 16, fruit with wings removed. (Drawings of 1 and flower parts based on Motley 215; 15 and 16 on Igon 322). *Scale applies to 1 and 15 only.*

**Plate 20.** **Hopea sulcata** Sym. 1, flowering twig. 2, flower bud. 3 and 4, outer sepals. 5, 6, and 7, inner sepals. 8 and 9, petal from flower bud. 10 and 11, stamens. 12, ovary. 13, section through ovary. 14, branchlet with fruits. 15, mature fruit showing nut. 16, nut from mature fruit. (Drawings of 1 and flower parts based on Forest Dept. F.M.S. 730; 14 on Forest Dept. F.M.S. 7907; 15 and 16 on Forest Dept. F.M.S. 43359). *Scale applies to 1, 14, and 15 only.*

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